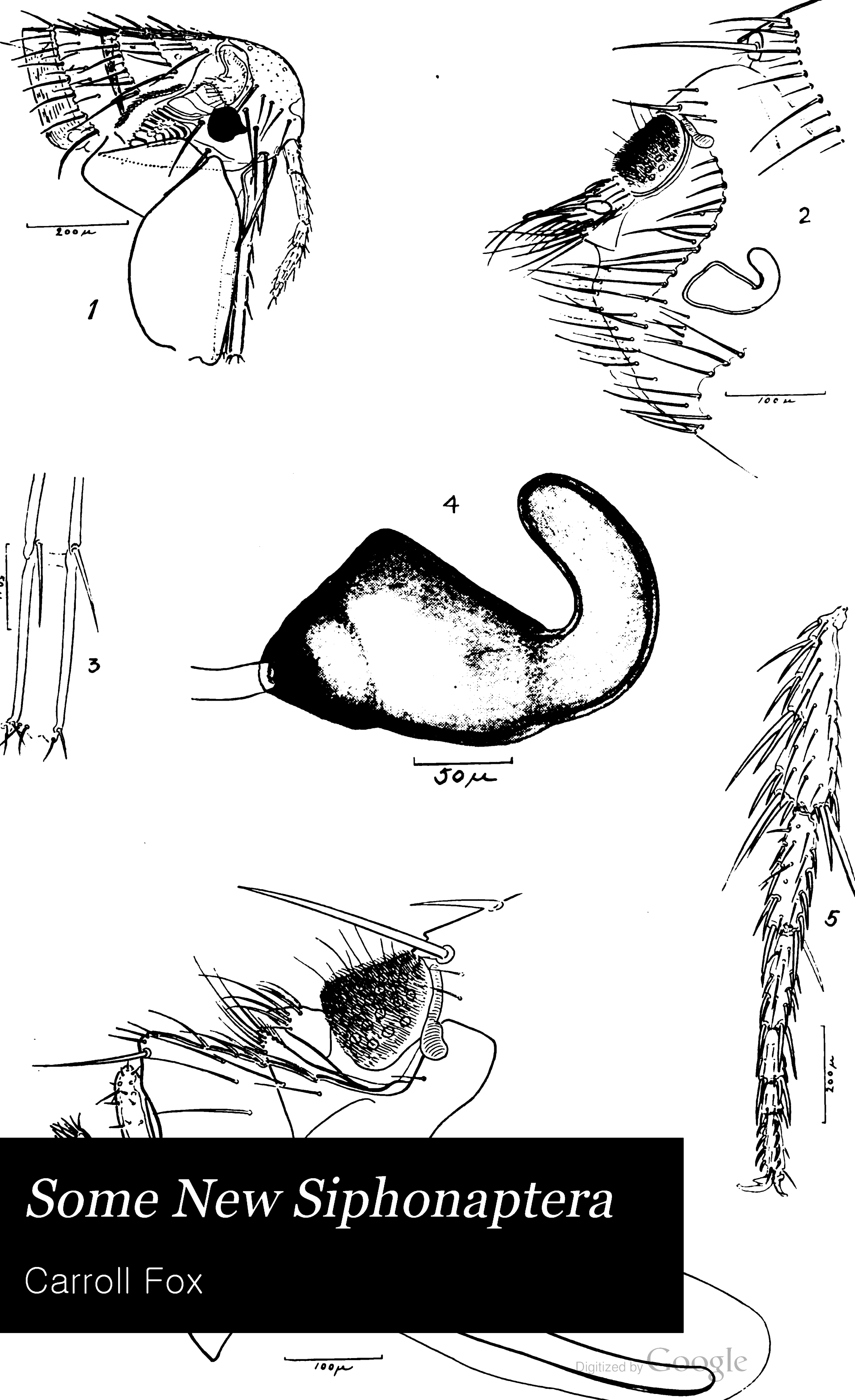


Some New Siphonaptera

Carroll Fox

TREASURY DEPARTMENT
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BY

CARROLL FOX

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1. SOME NEW SIPHONAPTERA.[1]

(Pls. I, II, III, IV, V.)

ROOSEVELTIELLA gen. nov.

A noncombed, noneyed, genus. The third joint of the antenna is short and distinctly segmented only on the posterior side. The antennal groove is partly overlapped by the gena. A row of stout hairs is to be found along the posterior border of the antennal groove more distinct in the male than in the female. The labial palpi are four jointed, including the basal unpaired segment. The tip of the rostrum is asymmetrical.

The first abdominal tergite is almost as long as the three thoracic nota taken together. The single antipygidial bristle in the male is placed on a cone, while in the female it is separate from the apical edge of the seventh tergite. The clasping organs conform to the type found in *Xenopsylla.*

The hind coxa is pyriform in shape with a shallow notch posteriorly at the apex. On the inner side of the hind coxa, there is a row of small teeth. The last tarsal joint of all the legs has 4 spines and an apical hair on either side with 2 subapical spines on the ventral surface.

ROOSEVELTIELLA GEORYCHI sp. n.

(Pl. I, figs. 1–6.)

Head.—The only bristle to be found on the anterior portion of the head is near the lower border of the gena. The gena is sharply pointed behind. The antennal groove in the male reaches to the top of the head, in the female to within one-third of the top. The second joint of the antenna has a row of slender hairs, which in the female are about as long as the third joint. There is 1 bristle back of the antennal groove and a subapical row of about 10 bristles on the hind margin of the occiput. The rostrum reaches to the apex of the fore coxa.

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[1] Manuscript submitted for publication July 7, 1914.

Thorax.—Each notum contains a single row of bristles (6 to 8, 12, 12). On the mesothorax there is 1 bristle. On the sternum of the metathorax there are 3 bristles with 1 on the episternum. On the epimerum are two rows of 5 or 6 bristles each. The pleura are normally divided.

Abdomen.—The first abdominal tergite contains an anterior row of 4 or 5 bristles and a posterior row of about 8. The other tergites from the second to the seventh have a single row of about 14 bristles each. The abdominal sternites from the third to the seventh have each a single row of about 10 bristles.

Legs.—On the inner side of the hind femur there is a row of 4 or 5 bristles, while apically on the outer surface there are 2. The hind tibia has on its dorsal border five pairs of bristles. On the inner surface of this segment close to the posterior border there is a row of about 8 bristles. The apical bristle of the second hind tarsal segment reaches well to the fifth.

Modified segments—Male.—The modified segments in both male and female resemble the *Xenopsylla scopulifer*. The second process in the male claspers, however, is broader toward the tip and is more curved on both sides. There are more bristles on the first process and they are heavier. The ninth sternite is more slender, decidedly so at the apex.

Female.—In the female, on the apical border of the eighth tergite, there is an external row of about 18 bristles and an internal row of 8 or 10. On the lateral surface from the stigma downward there is a row of about 8 bristles extending almost to the apical edge. In front of the 3 lowest bristles of this row there are 3 bristles in line.

Length of male, 1.7 mm.; length of female, 1.6 mm.

Twelve specimens of this flea, six males and six females, are contained in the collection at the United States National Museum. They were collected by the Misses M. and H. J. Melville about 300 miles inland from Benguela, Africa, off *Georychus*.

Type No. 18452, U. S. N. M.

XENOPSYLLA PROCAVIAE sp. n.

(Pl. II. figs. 1–5.)

Head.—The rostrum extends a little beyond the middle of the fore coxa. The antennal groove is closed behind and partly overlapped by the gena. There are but 2 bristles on the front of the head, 1 placed on the lower general edge and 1 near the edge. On the occiput there is a bristle back of the antennal groove and a subapical row of about 8.

Thorax.—The tergites have each a single row of bristles containing on the pronotum 10 bristles and on the meso and metanotum 7

bristles each. The pleura are normally divided. The mesothorax bears 3 bristles in the male and 4 in the female. The episternum of the metathorax has 1 bristle, the stermum of this segment 1 bristle, while the epimerum bears anteriorly 1 bristle and an apical row of 4.

Abdomen.—The abdominal tergites contain each a single row of bristles, the first having 6 bristles in the row and anteriorly a few scattered hairs. The others from the second to the sixth have about 10 bristles each. On the seventh tergite is a row of about 6 bristles, the lowest widely separated from the others. There is 1 antipygidial bristle on each side placed on the apical edge of the seventh tergite. The sternites from the third to the seventh bear in the male a bristle on each side, while in the female there is a row of 4 or 5 on the third, fourth, fifth, and sixth, and about 10 on the seventh, on the two sides taken together.

Legs.—The fore coxa has about 11 bristles on its outer surface. The hind coxa is sinuate behind and has a patch of about 10 teeth on its inner surface. The hind femur has but 2 bristles on its outer surface, located ventrally near the apex, and a row of 5 bristles on its inner surface. There is no tooth ventrally at its widest portion. The hind tibia bears a row of about 7 bristles on its outer surface and none on its inner surface. On the posterior border are 5 pairs of bristles and an apical group of 4 bristles. One of the apical bristles on the second hind tarsal segment extends beyond the base of the fifth segment. The fourth segment is short and triangular, and in the female the longest of its apical bristles extends to the apex of the fifth joint. The fifth segment contains on each side 4 spines and a subapical pair ventrally.

Modified segments—Male.—The clasper has two free processes with a third much smaller containing about 3 or 4 hairs, and not separated from the body. The first free process, the superior of the three, is longer than the others, narrow and regular in outline, and has from its tip downward a row of about 6 bristles. The second free process is shorter than the first, about as broad, and asymmetrical at its tip, where there are two groups of very small bristles or hairs. The manubrium is short and narrow. The ninth sternite, narrow and bluntly rounded at its tip, expands below to again become narrow at its angle.

Female.—There are two widely separated bristles beneath the pygidium on the lateral portion of the eighth segment. The apical margin is rounded, with an outside row of about 14 bristles and an inside row of about 6. The style is about twice as long as wide at the base.

Length of male 1.5 mm.; length of female, 1.7 mm.

Ten specimens, three males and seven females, are contained in the collection at the United States National Museum from British East

Africa, off *Procavia*, collected during the Smithsonian African Expedition.

Type No. 18453, U. S. N. M.

RHOPALOPSYLLUS GWYNI sp. n.

(Plate III, figs. 1–6.)

Head.—The frons bears an anterior row of 4 or 5 bristles and an eye row of 3 longer and stouter bristles. There are also 2 stout bristles on the gena, one located below and one behind the eye. The rostrum extends to the apex of the fore coxa. On the occiput there are three rows of bristles, an anterior of about 8, a middle of about 10, and a posterior subapical row of 10 or 12 bristles.

Thorax.—In the anterior row of the pronotum there are about 10 bristles and in the posterior row about 14. The mesonotum contains two rows of bristles with about 14 in the anterior and the same number in the posterior. The metanotum has three rows of bristles, an anterior of 7 or 8, a middle of about 16 and a posterior of about 14. On the apical edge of the metanotum there are 7 or 8 teeth. The mesothorax bears 4 bristles. The episternum of the metathorax bears 2 bristles and 2 hairs. There is a single bristle on the sterum, while the epimerum contains two rows of bristles of 5 or 6, and 4.

Abdomen.—Each abdominal tergite has two rows of bristles, first, 12 and 12; second, 12 and 14; third, 12 and 14; fourth, 10 and 14; fifth, 5 and 14; sixth, 3 or 4 and 14; seventh, 4 and 10. On the apical edge of the seventh tergite there is 1 long antipygidial bristle on each side, and a row of about 6 very fine bristles or hairs. The apical edge is not sinuate. The second abdominal segment contains laterally 4 fine bristles. Along the apical edge of the first tergite are about 12 small teeth.

Legs.—On the outer surface of the mid and fore femora are scattered 7 or 8 fine bristles and on the hind femur but 2 located basally. On the inner surface of the mid and hind femora are about 2 small bristles only. The hind tibia has on its outer surface arranged in three irregular rows about 18 bristles with a similar arrangement of a less number of bristles on the outer surface of the fore and mid tibia. On the inner surface of the fore and hind tibia are about 2 fine bristles. The last tarsal segment of all of the legs has 4 lateral spines with a supernumary pair apically. There is also a long hair on each side apically and a hair at the location of the third lateral bristle.

Modified segments—Male.—The claspers resemble somewhat those of *R. bohlsi.* The finger is heavier and the ninth sternite is slimmer and contains more hairs. The shape of the base of this sternite is also different.

Female.—From the stigma downward there is on the eighth abdominal segment a regular row of about 9 large and 8 smaller bristles, and anterior to this row are about 4 small bristles. There is also an apical outside row of about 7 or 8 and an inside row of 6 or 7 bristles.

Length of male, 2.4 mm.; length of female, 3.4 mm.

There are deposited in the Hygienic Laboratory four males and one female, collected by Surg. M. K. Gwyn, United States Public Health Service, at the quarantine station located at Brunswick, Ga., 1904, off "rats."

From the brief description of these rats given by Dr. Gwyn, it is likely that they were *Epimys norvegicus*. The genus *Rhopalopsyllus* being practically confined to South America, it is probable that the rats were brought from that continent by vessels stopping at the quarantine station.

Type No. 18454, U. S. N. M.

DORATOPSYLLA BLARINAE sp. n.

(Pl. IV, figs. 1-3.)

Head.—There are two rows of bristles extending almost vertically on the frons, an anterior of smaller bristles comprised of 5 and a posterior comprised of 3 large bristles. The gena along its lower edge bears 4 stout spines extending from the root of the maxillary pulpus to the margin of the antennal groove. On the occiput are three rows of bristles, an anterior of 3, a middle of 4, and the usual subapical row of about 6 on each side. Both the first and second joints of the antenna contained a row of short hairs. The rostrum extends to three-fourths the length of the fore coxa and consists of 5 joints including the unpaired basal joint. Its tip is rounded and symmetrical.

Thorax.—On the pronotum there is an anterior row of about 10 bristles and posterior to this a row of 14 or 15 spines, on the two sides together. The mesonotum bears a row of about 10 bristles, and the metanotum two rows of bristles, both the anterior and posterior row having about 6 bristles each. The pleura are normally divided. The mesothorax bears 6 bristles, one of them being situated anteriorly, and two at and near the posterior inferior angle, with a middle row of 3. On the metathorax there is 1 bristle on the episternum, 1 on the sternum, and two rows of 2 bristles each on the epimerum.

Abdomen.—The first abdominal tergite bears two rows of bristles, an anterior of 4 and a posterior of 7 or 8. The tergites from the second to the fourth bear likewise two rows of bristles, an anterior of about 10 and a posterior of 11 or 12. The fifth, sixth, and seventh

tergites have the posterior row of 10 or 11 bristles, the anterior row being represented by 2 bristles each. On the apical edge of the seventh tergite are 3 antipygidial bristles on each side, the middle being the longest. The sternites from the second to seventh bear each a single row of about 4 bristles, with an additional long bristle on the seventh sternite in line with and above the others.

Legs.—The fore coxa is clothed on its outer side with about 24 bristles. The midfemur is without a row of bristles. The hind coxa has no teeth on its inner side. The hind femur is without a row of bristles. The hind tibia has on its outer side about 10 bristles arranged in general in two rows, while on the posterior border are 5 pairs of bristles, every other pair being larger. Apically there is a group of 3 bristles, and situated between the second and third pair is a single small bristle. None of the bristles on the second tarsal joints of all the legs extend farther than the middle of the next succeeding joint. On the fifth joint of all the legs there are 4 pairs of lateral spines with a supernumerary pair ventrally at the base and a pair at the apex.

Modified segments.—The claspers contain two processes and a long, thin, slightly curved movable finger. The anterior process is short and blunt and bears three bristles, one quite heavy. The posterior process is much longer and has a single hair at its apex and a few on the posterior margin. On the posterior border of the finger there are 3 widely separated fine bristles. Arising from the clasper at the root of the finger is a single long, strong bristle. The ninth sternite is broad, narrowing at the apex, and from the posterior border at the widest part is a short, thick bristle, while above this is another finer one, and near the apex two or three hairs.

Length, 1.7 mm.

There is one specimen of this flea (male) in the collection at the United States National Museum, collected by Mr. G. S. Miller, in Washington, D. C., off *Blarina brevicauda.*

Type No. 18455, U. S. N. M.

CERATOPHYLLUS STIMSONI sp. n.

(Pl. IV, figs. 4–6.)

Head.—The frontal notch is distinct, the eye is absent. The maxillary palpi are not as long as the labial palpi. The rostrum extends about three-fourths the length of the fore coxa. The antennal groove reaches to the top of head. There are 6 bristles in the upper or anterior genal row, one being placed at the anterior edge of the antennal groove slightly above the others, and four stouter bristles in the lower or posterior genal row. One bristle is located back of the antennal groove. There are numerous fine hairs along the pos-

terior margin of the groove. There are about 10 subapical bristles along the posterior border of the occiput; a few short hairs can be seen on the margin of the second joint of the antenna.

Thorax.—The pronotum bears a ctenedium of 18 spines, while anterior to this comb there is a row of about 10 bristles. The meso- and meta-notum have each two rows of bristles. The anterior and posterior rows on the mesonotum are comprised of about 10 bristles each, while on the metanotum the bristles in both rows are more numerous. The mesothorax contains 7 bristles, 5 of which are found posterior to its dividing internal incrassation, while there are 1 large and 2 small bristles or hairs anterior to this division. The episternum of the metathorax bears 5 bristles, while just below, springing from the sternum, are 2 large bristles. The epimerum has three somewhat irregular rows of bristles consisting of 4, 5, and 3, the latter being located close to or at the posterior margin.

Abdomen.—The first abdominal tergite has an anterior row of about 10 and a posterior row of about the same number, but heavier, bristles. The other tergites have each two rows of bristles, an anterior row of about 16 small, and a posterior row of from 20–24 larger bristles. The second, third, fourth, and fifth tergites have each a small tooth on each side. There is 1 apical bristle on the seventh segment, extending well beyond the sensory plate. The abdominal sternites from the third to the seventh have each two rows of bristles, consisting of from 3 to 4 bristles in each row, the posterior being the heaviest.

Legs.—The hind femur has a row of about 10 bristles on the outer surface, and a row of 7 or 8 bristles on the inner surface. There are two irregular rows of bristles on the outer surface of the hind tibia close to the posterior border. One of the bristles on the posterior border of the hind tibia is unusually long. The longest apical bristle of the first hind tarsus reaches to beyond the base of the second tarsal segment. The longest apical bristle of the second tarsal segment reaches to the middle of the fifth. The last tarsal joints of all the legs have five pairs of lateral spines, the first pair being slightly dislocated toward the median line.

Modified segments.—The manubrium is broad at its base but contracted at its apex. The process is small, slightly expanding at its apex where there are 3 long slender bristles. The movable finger is long and narrow, slightly curved throughout its length, and ending above in a more or less recurved tip. At its insertion it is markedly curved. In general it has the shape of the blade of a scythe. The bristles frequently seen at the insertion of the finger are in this case absent. The ninth sternite can be better understood

from the drawing than from a description. The eighth sternite is prominent and contains several small hairs along the posterior border below its apex.

Length, 2.4 mm.

There are in the personal collection of the author two specimens of this flea (males) collected by Passed Asst. Surg. Arthur M. Stimson, United States Public Health Service, in Los Angeles, Cal., 1908, off "Gophers" (*Thomomys*).

Type No. 18456, U. S. N. M.

CERATOPHYLLUS APACHINUS sp. n.

(Pl. V, figs. 1–3.)

The specimen, a female, has been mutilated during its collection or preservation and therefore the following description is lacking in certain details.

Head.—The rostrum extends to the apex of the trochanter, or possibly a little beyond. The antenna is relatively small. Its second joint bears a row of hairs which are longer than the third joint. The eye is absent.

Thorax.—On the pronotum there is a ctenedium of about 22 spines and anteriorly a row of about 16 bristles. The bristles on the other thoracic nota can not be determined accurately, but it appears that the mesonotum has two rows of numerous bristles and the metanotum three rows.

Abdomen.—Like the other prairie dog fleas the abdomen is markedly hairy. Each tergite bears two rows of bristles of about 24 bristles each. On the apical edge of the seventh tergite are 3 long, strong, antipygidial bristles on each side. The second sternite bears about 2 bristles. The sternites from the third to the sixth, have each three rows of bristles, the third row much reduced in numbers. The posterior row has about 14 and the anterior row about 8 smaller bristles. On the seventh sternite ventrally there is a group of about 7 bristles and above this group on each side may be seen 3 more in line. Anteriorly, this segment also contains the row of small bristles common to the others.

Legs.—The mid-femur has on its inner surface a row of about 10 bristles. The hind coxa is broad, about as broad as it is long. The hind femur contains on its outer surface a row consisting of about 10 bristles and on its inner surface a row of about the same number. On the posterior border of the hind tibia are 7 pairs of bristles and an apical group of 4. The inner surface of this segment bears a row of about 7 bristles, and the outer surface about 16 arranged in two rows.

Modified segments.—The terminal segments of the abdomen are quite hairy. There are about 15 small bristles or hairs on the eighth tergite anterior to the sensory plate, while below this plate there are 4 large and 3 small bristles. The lateral surface of the eighth segment contains a patch of about 20 large and small bristles extending to the apical edge. The style is stout and terminates in a bristle. Subapically there is another bristle and several hairs. The tenth sternite is hairy and bears along its margin 5 or 6 stout bristles on each side.

Length, 3.3 mm.

A single male specimen is contained in the collection at the United States National Museum. It came from Apache County, N. Mex., off "Prairie dog" (probably *Cynomys arizonensis*).

Type No. 18458 U. S. N. M.

CERATOPHYLLUS GIBSONI sp. n.

(Pl. V, figs. 4–5.)

The specimens have been permitted to remain too long in caustic solution and are somewhat distorted and certain details obscured. This flea partakes of the general appearance of other bird fleas.

Head.—The rostrum reaches almost to the apex of the fore coxa. Eyes are present.

Thorax.—The pronotum bears a ctenedium of 25 spines with a row of bristles anteriorly. The other thoracic nota bear two rows of bristles each, containing about 10 bristles in each row. There is a small tooth on each side on the apical margin of the metanotum.

Abdomen.—The first abdominal tergite bears three rows of bristles, a posterior and middle of about 12 each and an anterior row of about 8 bristles. On the other tergites is a posterior row of about 12 and an anterior row of 8 or 10 smaller bristles. On the apical edge of each of the first 4 tergites are 2 teeth on each side. There is 1 antipygidial bristle on each side. On each of the sternites from the second to the seventh is a single row of about 6 bristles.

Modified segments—Male.—The clasping organs resemble somewhat those of the C. niger. The manubrium is broader and the movable finger notched on its dorsal edge.

Female.—The receptaculum seminis has an entirely different shape from that of C. niger.

Length of male, 2.2 mm.; length of female, 1.9 mm.

Two specimens (male and female) are in the collection at the United States National Museum. Collected by Mr. Arthur Gibson in a hen house, Point Lepreux, Ottawa, Canada, July 13, 1909.

Type No. 18457, U. S. N. M.

ISCHNOPSYLLUS, TEXANUS sp. n.

(Pl. V, figs. 6–8.)

Head.—The cephalic processes are rather long and slender. The eye is absent but is represented by a thickening of the chitin. The antennal groove extends to the top of the head and from its extension reaching to the anterior border of the frons is a row of about 12 small bristles. Just below the row, 1 located near the antennal groove, and 1 near the anterior border of the head, are 2 larger bristles, while scattered on the lateral surface are numerous fine hairs. Along the posterior margin of the antennal groove are two rows of bristles, one close to the margin and comprised of about 12 smaller bristles, and immediately above a row of about 4 larger. Running obliquely across the occiput are four more or less regular rows of bristles of 4, 3, 5, and 5 or 6 on each side, with the usual row along the posterior margin. At the inferior posterior angle of the occiput there are 3 bristles, the uppermost the longest and the lowest the shortest. From the anterior edge of the antennal groove springs a long bristle, the largest to be found on the head. The first joint of the antenna has a patch of about 8 stout hairs, while along the margin of the second joint is a row of 7 or 8 thinner but longer hairs—not as long as the third joint.

Thorax.—The pronotum contains a ctenedium of about 26 spines, and three rows of bristles of 4 to 6 in the anterior, 12 to 14 in the middle, and about 10 in the posterior. In addition to these there are several hairs at the posterior inferior angle. The mesonotum is the longest of the nota and has a number of bristles more or less regularly disposed in five or six rows, the anterior rows being very irregular and the bristles smaller. The metanotum has numerous bristles rather irregularly placed. The apical edge of this notum bears a small tooth on each side. The mesothorax has about 4 bristles posteriorily, and a patch of about 12 anteriorly. The episternum of the metathorax is small and contains 3 bristles, the sternum 1 bristle, and the epimerum three rows of bristles (2, 4, 3).

Abdomen.—The first, second, and third abdominal tergites contain each a single tooth on each side. Each tergite has three rows of about 10 or 12 bristles, the bristles in the anterior and middle rows being somewhat irregularly placed. There is 1 long apical bristle springing from the seventh tergite. The sternites from the third to the sixth have each two rows of bristles, an anterior of 10, and a posterior of less numerous smaller ones. The seventh has two rows of about 12 bristles each.

Legs.—The hind femur is without a row of bristles on either surface. There are 3 bristles situated on the outer surface basally and 3 apically, and on the inner surface basally a few small ones.

The anterior border carries a row of 3 bristles toward the apex. On the posterior border of the hind tibia there are 4 single and 1 pair of long bristles including the apical bristles, and in addition several much smaller bristles singly, or in pairs. The outer surface contains numerous bristles arranged more or less regularly in three rows. On the inner surface is a row of 6 bristles close to the anterior border. The tarsi are very hairy. The first tarsal joint in both the hind and middle legs is about as long as its respective tibia. The first pair of lateral spines on the fifth tarsal joints is situated between the second pair.

Modified segments.—On the lateral surface of the eighth abdominal segment below the sensory plate there is a group of 4 bristles, while toward the inferior surface there are 5 regularly placed bristles (2, 3). On the apical margin are 8 thick-set bristles. Two bristles are situated on the edge of the eighth sternite.

Length, 2.6 mm.

There is one specimen of this flea (female) in the collection at the United States National Museum, collected in Pecos, Tex., March 21, 1902, off a "bat" (*Nyctinomus mexicanus*).

Type No. 18459, U. S. N. M.

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II. A FURTHER REPORT ON THE IDENTIFICATION OF SOME SIPHONAPTERA FROM THE PHILIPPINE ISLANDS.

Since the first report on this subject[1] the writer has had an opportunity to study several other series of fleas taken off different hosts in the Philippine Islands. The results have been similar to those previously reported, namely, that the *Xenopsylla cheopis* Roths. was the only rat flea found and that the *Ctenocephallus canis* Dugés seems to be absent as in India and Panama. It is apparently a flea which does not thrive in the Tropics.

In the article previously mentioned there was a statement made which is erroneous and will therefore be corrected here. It was said that the *Ctenocephallus felis* Bouché of the Philippine Islands differed from that of the United States and Europe. As a matter of fact the differences pointed out at that time were not differences at all, but common characteristics.

In addition to the specimens previously reported upon the following have been collected and identified:

TABLE 1.—*Specimens of Xenopsylla cheopis Rothschild examined.*

Host.	Males.	Females.	Total.	Locality.	Date.
Epimys norvegicus	1	6	7	Manila	July, 1912.
Epimys alexandrinus		2	2	...do	Do.
Epimys querceti	7	10	17	...do	Do.
Mus commissarius	1	3	4	...do	Do.
Epimys norvegicus	67	68	135	Iloilo	August, September, and October, 1912.
Epimys alexandrinus	16	11	27	...do	Do.
Epimys rattus	24	28	52	...do	Do.
Pachyura occultidens	11	8	19	...do	Do.
	127	136	263		

TABLE 2.—*Specimens of Ctenocephallus felis Bouché examined.*

Host.	Males.	Females.	Total.	Locality.	Date.
Epimys norvegicus	1	1	2	Iloilo	October, 1912.
Epimys rattus	1		1	...do	Do.
Canis familiaris	18	24	42	...do	November, 1912.
Felis domestica	7	17	24	...do	Do.
Wild cat sp.	10	21	31	Palawan	January, 1909.
Homo sapiens	1		1	Iloilo	September, 1912.
Do.		1	1	Manila	October, 1912.
	38	64	102		

TABLE 3.—*Specimens of Pulex irritans Linn. examined.*

Host.	Males.	Females.	Total.	Locality.	Date.
Canis familiaris		1	1	Iloilo	November, 1912.

[1] Philippine Journal of Science, Vol. VII, No. 2, sec. B. The Philippine Journal of Tropical Medicine, April, 1912.

III. THE TAXONOMIC VALUE OF THE COPULATORY ORGANS OF THE FEMALES IN THE ORDER SIPHONAPTERA.

(Pl. VI–XXII.)

It is strange that students of the Siphonaptera, who depend to such a large extent upon the characters of the clasping organs of the males in determining the species, have not also taken more advantage of the almost equally characteristic copulatory organs of the females, especially of that organ known as the receptaculum seminis or spermatheca.

Until the appearance of Lass's article on the anatomy of the dog flea no attention had been paid to any part but the receptaculum seminis, and to that organ but few had given more than a superficial or more or less inaccurate description. In 1900 Rothschild mentions it as the abdominal gland and pictures it in differentiating between the *Ceratophyllus gallinae* and the *Ceratophyllus hirundinis*. Later he drew specific attention to it in differentiating between the *Xenopsylla nubicus*, the *X. cheopis*, the *X. aequisetosus*, and the *X. brasiliensis*, and in all of his recent writings he pictures the *spermatheca*. Wagner has described it for the *Hystrichopsyllus talpae*, a flea belonging to a genus the members of which have a double receptaculum seminis. Baker mentions the fact that it "possesses a very characteristic form in many of the species." He says, however, that "it rests in various positions, and this makes its comparative study very difficult."

The writer, after having studied thousands of specimens of *Xenopsylla cheopis* Roths., *Ceratophyllus fasciatus* Bosc., *Ctenocephallus canis* Duges, *Ctenocephallus felis* Curtis, *Pulex irritans* Linn., as well as numerous specimens of other species, was impressed with the marked differences in the shape of the spermatheca and in its other general characteristics in the different species, and with the fact that the characteristics remain constant for the species; and that, while it may assume different positions in the abdomen, in the majority of instances its position is such that it may be easily studied. In fact, that it is almost as valuable in the determination of species in the female as the claspers are in the male, except, perhaps, in some very closely allied species. He started to write an article on this subject in 1908, but was interrupted and has only recently been in position to continue. In the meantime Oudemans published a valuable article,

not only pointing out the value of the receptaculum seminis as an aid to identification, but also differences in the bursa copulatrix and the accessory ducts.

In the following description of the anatomy of the female copulatory organs, Lass is followed more or less closely.

The vagina has its origin at the vulva, which is formed by the eighth and ninth abdominal segments and is located close to the ventral wall of the abdomen, following its contour and ending in the uterus, which in turn becomes continuous with the oviducts. Just within the vulva (anterior) is seen an arborescent mass with a varying number of branches, depending on the species. This is known as the glandula vaginalis and empties by a very short duct into the roof of the vagina. It is probably the colleterial gland. Still anterior is the opening of the bursa copulatrix, while immediately in front of this is the duplicatura vaginalis, an invagination of the roof of the vagina which probably acts as a valve or stop, preventing the passage of the penis into the uterus, at the same time directing the passage of this organ into the bursa. Lass says that its lining membrane is ciliated and that it may act as a tickling organ.

The bursa copulatrix is shaped somewhat like the letter S. It receives the penis during copulation. It may be divided into three parts, a lower portion or duct which is surrounded by tissue possibly of a glandular nature; a middle portion, usually more chitinous than the rest, more or less rigid, and which in the passive condition has its walls more or less collapsed; and an upper portion which is dilated, forming a sac or pouch, as in the *Xenopsylla cheopis* or an elongated tube as in the *Ceratophyllus fasciatus*. These are probably extreme examples and between them many variations exist. At times, as in the *Ctenopsylla musculi*, the upper portion of the bursa is more highly chitinized than the middle.

Into the upper or dilated portion of the bursa there open two ducts. One, the longer, more tortuous, is known as the ductus receptaculi seminis, which connects the bursa with the receptaculum seminis. This duct varies greatly in diameter, length, and tortuosity in the different species and connects with the body of the spermatheca at the external os. Its first or distal part is, in some species, dilated, and to this portion Oudemans has suggested the name of pars dilatata. The other duct is a shorter, blind duct known as the ductus obturatorius. It is probably a vestigial organ representing the second ductus receptaculi seminis in those fleas having a double receptaculum seminis, an adherence to the original type. The ductus obturatorius expands slightly at its blind termination. It varies in length and diameter in the different species and is sometimes apparently absent. It may be very short, as in the *C. fasciatus*, or it may be almost as long as the ductus receptaculi seminis, as in the *C.*

bruneri, and at times, as in the *C. niger*, is very prominent by reason of the high degree of chitinization in a part of its length. At least in three species, namely the *Xenopsylla cheopis*, the *X. brasiliensis* and the *Ceratophyllus wagneri*, it opens into the pars dilatata of the ductus receptaculi seminis.

The receptaculum seminis is the reservoir for the spermatozoa. In the fertilized female a section of the spermatheca will show both the body and the appendix filled with spermatozoa. This organ, according to Mitzmain, pulsates rhythmically during copulation. He says that it is faintly discernible during the act, as it swells and collapses. It is probable that by this action the spermatozoa are drawn up into its interior to be stored until needed to fertilize the egg. During the passage of the egg through the egg canal, preparatory to oviposition the spermatozoa, aided by the secretion from the gland cells which surround the external os and portions of the duct, make their way back to the mouth of the bursa where they enter the egg through the microphyles.

The receptaculum seminis may be divided into a dilated portion or body and a contracted portion or appendix. There is an opening in the body which may be called the external os, to the margins of which there is attached the ductus receptaculi seminis. The opening between the interior of the body and the interior of the appendix may be called the internal os. The appendix is more or less bent on the body, forming a hollow or concavity. Spanning this concavity and connecting the body with the appendix are a number of muscle fibers. These muscle fibers, by their contraction, probably cause the rhythmical pulsations mentioned above, the spermatheca returning naturally to its original shape by reason of the elastic properties of the chitin which enters to a great extent into the composition of the organ.

In the interior of the spermatheca the chitin forms a series of ridges or rugae, most pronounced in the body and toward the blind end of the appendix. The area of the body immediately surrounding the external os is perforated with numerous minute holes and will therefore be called the cribiform area. Built up around the external os and surrounding the beginning of the ductus receptaculi seminis are numerous gland cells which empty into the interior of the body through the minute perforations in the cribiform area. These cells probably furnish a secretion which keeps the contents of the spermatheca fluid and a suitable medium in which the spermatozoa can remain alive for long periods.

The external os may be located concentrically or eccentrically within the cribiform area, depending on the species.

The spermatheca is usually found in an upright position with the external os directed in general caudo-ventrad. The appendix points

in various directions, depending upon the degree of curvature in the particular species under study. It may point caudad, ventrad, cephelad, or in intermediate positions.

The most important for purposes of identification is the spermatheca because of its striking and characteristic appearance, and because it is unusual not to see it plainly in all specimens properly prepared. Next in importance is the bursa copulatrix which is often dark, at least in part, and usually to be made out with ease. On the other hand, the ducts are more difficult to see and study, and to be certain of their arrangement and character a series of specimens is frequently necessary. It should be mentioned that while the general relation, diameter, length, and tortuosity of the ducts remain constant in the same species, the loops formed by the tortuous ducts do not necessarily lie in the same position, nor do the tubes and bends necessarily take the same direction.

Oudemans has arranged his material into three groups—a *sciurorum*, a *fringillae*, and a *fasciatus* group. It is thought that such a division is hardly helpful, as specific variations are so numerous that a grouping based on general characteristics would be of little value.

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DESCRIPTION OF PLATES.

PLATE I.

FIG. 1. Head of Rooseveltiella georychi, male.
2. Apex of labial palpus of Rooseveltiella georychi.
3. Genitalia of Rooseveltiella georychi, male.
4. Terminal segments of abdomen Rooseveltiella georychi, female.
5. Hind tarsi of Rooseveltiella georychi.
6. Receptaculum seminis of Rooseveltiella georychi.

PLATE II.

FIG. 1. Head of Xenopsylla procaviæ, male.
2. Genitalia of Xenopsylla procaviæ, male.
3. Terminal segments of abdomen of Xenopsylla procaviæ, female.
4. Hind tarsi of Xenopsylla procaviæ.
5. Receptaculum seminis of Xenopsylla procaviæ.

PLATE III.

FIG. 1. Head of Rhopalopsyllus gwyni, male.
2. Terminal segments of abdomen of Rhopalopsyllus gwyni, female.
3. Apex of labial palpus of Rhopalopsyllus gwyni.
4. Receptaculum seminis of Rhopalopsyllus gwyni.
5. Hind tibia and tarsi of Rhopalopsyllus gwyni.
6. Genitalia of Rhopalopsyllus gwyni, male.

PLATE IV.

FIG. 1. Head of Doratopsylla blarinæ, male.
2. Genitalia of Doratopsylla blarinæ, male..
3. Second, third, fourth, and fifth hind tarsal segments of Doratopsylla blarinæ.
4. Head of Ceratophyllus stimsoni, male.
5. Genitalia of Ceratophyllus stimsoni, male.
6. Second, third, fourth, and fifth hind tarsal segments of Ceratophyllus stimsoni.

PLATE V.

FIG. 1. Head of Ceratophyllus apachinus, female.
2. Terminal segments of abdomen of Ceratophyllus apachinus, female.
3. Receptaculum seminis of Ceratophyllus apachinus.
4. Receptaculum seminis of Ceratophyllus gibsoni.
5. Genitalia of Ceratophyllus gibsoni, male.
6. Head of Ischnopsyllus texanus, female.
7. Terminal segments of abdomen of Ischnopsyllus texanus, female.
8. Receptaculum seminis of Ischnopsyllus texanus.

PLATE VI.

FIG. 1. Copulatory organs of Ceratophyllus fasciatus, female.

PLATE VII.

FIG. 2. Copulatory organs of Ceratophyllus niger, female.
3. Copulatory organs of Ceratophyllus acutus, female.

PLATE VIII.

FIG. 4. Copulatory organs of Ceratophyllus californicus, female.
5. Copulatory organs of Ceratophyllus telchinum, female.

PLATE IX.

FIG. 6. Copulatory organs of Ceratophyllus multidentatus, female.
7. Copulatory organs of Ceratophyllus sexdentatus, female.
8. Copulatory organs of Ceratophyllus tuberculatus, female.

PLATE X.

FIG. 9. Copulatory organs of Ceratophyllus bruneri, female.
10. Copulatory organs of Ceratophyllus labiatus, female.
11. Copulatory organs of Ceratophyllus wagneri, female.

PLATE XI.

FIG. 12. Copulatory organs of Ceratophyllus idahoensis, female.
13. Copulatory organs of Ceratophyllus wickhami, female.
14. Copulatory organs of Ceratophyllus eremicus, female.

PLATE XII.

FIG. 15. Copulatory organs of Ceratophyllus franciscanus, female.
16. Copulatory organs of Ceratophyllus ignotus, female.
17. Copulatory organs of Ceratophyllus hirsutus, female.

PLATE XIII.

FIG. 18. Copulatory organs of Dasypsyllus perpinnatus, female.
19. Copulatory organs of Odontopsyllus charlottensis, female.
20. Copulatory organs of Odontopsyllus wymani, female.

PLATE XIV.

FIG. 21. Copulatory organs of Pulex irritans, female.
22. Copulatory organs of Xenopsylla cheopis, female.
23. Copulatory organs of Xenopsylla brasiliensis, female.

PLATE XV.

FIG. 24. Copulatory organs of Spilopsyllus inaequalis, female.
25. Copulatory organs of Ctenopsylla genalis, female.
26. Copulatory organs of Ctenopsylla musculi, female.

PLATE XVI.

FIG. 27. Copulatory organs of Ctenophthalmus heiseri, female.
28. Copulatory organs of Ctenophthalmus pseudagyrtes, female.
29. Copulatory organs of Echidnophaga gallinacea, female.

PLATE XVII.

FIG. 30. Receptaculum seminis of Ceratophyllus fasciatus.
31. Receptaculum seminus of Ceratophyllus idahoensis.
32. Receptaculum seminis of Ceratophyllus ignotus.
33. Receptaculum seminis of Ceratophyllus franciscanus.

34. Receptaculum seminis of Ceratophyllus montanus.
35. Receptaculum seminis of Ceratophyllus bruneri.
36. Receptaculum seminis of Ceratophyllus acutus.
37. Receptaculum seminis of Ceratophyllus tuberculatus.

PLATE XVIII.

FIG. 38. Receptaculum seminis of Ceratophyllus californicus.
39. Receptaculum seminis of Ceratophyllus divisus.
40. Receptaculum seminis of Ceratophyllus proximus.
41. Receptaculum seminis of Ceratophyllus ciliatus.
42. Receptaculum seminis of Ceratophyllus sexdentatus
43. Receptaculum seminis of Ceratophyllus telchinum.
44. Receptaculum seminis of Ceratophyllus wickhami.
45. Receptaculum seminis of Ceratophyllus leucopus.

PLATE XIX.

FIG. 46. Receptaculum seminis of Ceratophyllus niger.
47. Receptaculum seminis of Ceratophyllus styloeus.
48. Receptaculum seminis of Ceratophyllus wagneri.
49. Receptaculum seminis of Ceratophyllus keeni.
50. Receptaculum seminis of Ceratophyllus labiatus.
51. Receptaculum seminis of Ceratophyllus multidentatus.
52. Receptaculum seminis of Hystrichopsylla dippiei.
53. Receptaculum seminis of Anomiopsyllus nudatus.

PLATE XX.

FIG. 54. Receptaculum seminis of Ctenopsylla musculi.
55. Receptaculum seminis of Ctenopsylla hesperomys.
56. Receptaculum seminis of Ctenopsylla genalis.
57. Receptaculum seminis of Dasypsylla perpinnatus.
58. Receptaculum seminis of Odontopsyllus wymani.
59. Receptaculum seminis of Odontopsyllus charlottensis.
60. Receptaculum seminis of Ctenophthalmus heiseri.
61. Receptaculum seminis of Ctenophthalmus pseudagyrtes.

PLATE XXI.

FIG. 62. Receptaculum seminis of Xenopsylla cheopis.
63. Receptaculum seminis of Xenopsylla brasiliensis.
64. Receptaculum seminis of Pulex irritans.
65. Receptaculum seminis of Pulex dugesii.
66. Receptaculum seminis of Hoplopsyllus lynx.
67. Receptaculum seminis of Hoplopsyllus anomalus.
68. Receptaculum seminis of Rhopalopsyllus australis.
69. Receptaculum seminis of Rhopalopsyllus lutzii.

PLATE XXII.

FIG. 70. Receptaculum seminis of Spilopsyllus inaequalis.
71. Receptaculum seminis of Hectopsylla pulex.
72. Receptaculum seminis of Echidnophaga gallinacea.

HYGIENIC LABORATORY BULLETINS OF THE PUBLIC HEALTH SERVICE.

The Hygienic Laboratory was established in New York, at the Marine Hospital on Staten Island, August, 1887. It was transferred to Washington, with quarters in the Butler Building, June 11, 1891, and a new laboratory building, located in Washington, was authorized by act of Congress March 3, 1901.

The following *bulletins* [Bulls. Nos. 1-7, 1900 to 1902, Hyg. Lab., U. S. Mar.-Hosp. Serv., Wash.] have been issued:

*No. 1.—Preliminary note on the viability of the *Bacillus pestis*. By M. J. Rosenau.

No. 2.—Formalin disinfection of baggage without apparatus. By M. J. Rosenau.

*No. 3.—Sulphur dioxid as a germicidal agent. By H. D. Geddings.

*No. 4.—Viability of the *Bacillus pestis*. By M. J. Rosenau.

No. 5.—An investigation of a pathogenic microbe (*B. typhi murium* Danyz) applied to the destruction of rats. By M. J. Rosenau.

*No. 6.—Disinfection against mosquitoes with formaldehyde and sulphur dioxid. By M. J. Rosenau.

†No. 7.—Laboratory technique: Ring test for indol, by S. B. Grubbs and Edward Francis; Collodium sacs, by S. B. Grubbs and Edward Francis; Microphotography with simple apparatus, by H. B. Parker.

By act of Congress approved July 1, 1902, the name of the "United States Marine-Hospital Service" was changed to the "Public Health and Marine-Hospital Service of the United States," and three new divisions were added to the Hygienic Laboratory.

Since the change of name of the service the bulletins of the Hygienic Laboratory have been continued in the same numerical order, as follows:

*No. 8.—Laboratory course in pathology and bacteriology. By M. J. Rosenau. (Revised edition, March, 1904.)

†No. 9.—Presence of tetanus in commercial gelatin. By John F. Anderson.

*No. 10.—Report upon the prevalence and geographic distribution of hookworm disease (uncinariasis or anchylostomiasis) in the United States. By Ch. Wardell Stiles.

*No. 11.—An experimental investigation of *Trypanosoma lewisi*. By Edward Francis.

*No. 12.—The bacteriological impurities of vaccine virus; an experimental study. By M. J. Rosenau.

*No. 13.—A statistical study of the intestinal parasites of 500 white male patients at the United States Government Hospital for the Insane; by Philip E. Garrison, Brayton H. Ransom, and Earle C. Stevenson. A parasitic roundworm (*Agamomermis culicis* n. g., n. sp.) in American mosquitoes (*Culex sollicitans*); by Ch. Wardell Stiles. The type species of the cestode genus *Hymenolepis*, by Ch. Wardell Stiles.

*No. 14.—Spotted fever (tick fever) of the Rocky Mountains; a new disease. By John F. Anderson.

*No. 15.—Inefficiency of ferrous sulphate as an antiseptic and germicide. By Allan J. McLaughlin.

*No. 16.—The antiseptic and germicidal properties of glycerin. By M. J. Rosenau.

*No. 17.—Illustrated key to the trematode parasites of man. By Ch. Wardell Stiles.

*No. 18.—An account of the tapeworms of the genus *Hymenolepis* parasitic in man, including reports of several new cases of the dwarf tapeworm (*H. nana*) in the United States. By Brayton H. Ransom.

*No. 19.—A method for inoculating animals with precise amounts. By M. J. Rosenau.

*No. 20.—A zoological investigation into the cause, transmission, and source of Rocky Mountain "spotted fever." By Ch. Wardell Stiles.

*No. 21.—The immunity unit for standardizing diphtheria antitoxin (based on Ehrlich's normal serum). Official standard prepared under the act approved July 1, 1902. By M. J. Rosenau.

*No. 22.—Chloride of zinc as a deodorant, antiseptic, and germicide. By T. B. McClintic.

*No. 23.—Changes in the pharmacopœia of the United States of America. Eighth Decennial Revision. By Reid Hunt and Murray Galt Motter.

No. 24.—The international code of zoological nomenclature as applied to medicine. By Ch. Wardell Stiles.

*No. 25.—Illustrated key to the cestode parasites of man. By Ch. Wardell Stiles.

*No. 26.—On the stability of the oxidases and their conduct toward various reagents. The conduct of phenolphthalein in the animal organism. A test for saccharin, and a simple method of distinguishing between cumarin and vanillin. The toxicity of ozone and other oxidizing agents to lipase. The influence of chemical constitution on the lipolytic hydrolysis of ethereal salts. By J. H. Kastle.

*No. 27.—The limitations of formaldehyde gas as a disinfectant with special reference to car sanitation. By Thomas B. McClintic.

*No. 28.—A statistical study of the prevalence of intestinal worms in man. By Ch. Wardell Stiles and Philip E. Garrison.

*No. 29.—A study of the cause of sudden death following the injection of horse serum. By M. J. Rosenau and John F. Anderson.

†No. 30.—I. Maternal transmission of immunity to diphtheria toxine. II. Maternal transmission of immunity to diphtheria toxine and hypersusceptibility to horse serum in the same animal. By John F. Anderson.

†No. 31.—Variations in the peroxidase activity of the blood in health and disease. By Joseph H. Kastle and Harold L. Amoss.

†No. 32.—A stomach lesion in guinea pigs caused by diphtheria toxine and its bearing upon experimental gastric ulcer. By M. J. Rosenau and John F. Anderson.

*No. 33.—Studies in experimental alcoholism. By Reid Hunt.

†No. 34.—I. *Agamofilaria georgiana* n. sp., an apparently new roundworm parasite from the ankle of a negress. II. The zoological characters of the roundworm genus *Filaria* Mueller, 1787. III. Three new American cases of infection of man with horsehair worms (species *Paragordius varius*), with summary of all cases reported to date. By Ch. Wardell Stiles.

†No. 35.—Report on the origin and prevalence of typhoid fever in the District of Columbia. By M. J. Rosenau, L. L. Lumsden, and Joseph H. Kastle. (Including articles contributed by Ch. Wardell Stiles, Joseph Goldberger, and A. M. Stimson.)

†No. 36.—Further studies upon hypersusceptibility and immunity. By M. J. Rosenau and John F. Anderson.

†No. 37.—Index-catalogue of medical and veterinary zoology. Subjects: Trematoda and trematode diseases. By Ch. Wardell Stiles and Albert Hassall.

No. 38.—The influence of antitoxin upon post-diphtheritic paralysis. By M. J. Rosenau and John F. Anderson.

†No. 39.—The antiseptic and germicidal properties of solutions of formaldehyde and their action upon toxines. By John F. Anderson.

†No. 40.—1. The occurrence of a proliferating cestode larva (*Sparganum proliferum*) in man in Florida, by Ch. Wardell Stiles. 2. A reexamination of the type specimen of *Filaria restiformis* Leidy, 1880=*Agamomermis restiformis*, by Ch. Wardell Stiles. 3. Observations of two new parasitic trematode worms: *Homalogaster philippinensis* n. sp., *Agamodistomum nanus* n. sp., by Ch. Wardell Stiles and Joseph Goldberger. 4. A reexamination of the original specimen of *Tænia saginata abietina* (Weinland, 1858), by Ch. Wardell Stiles and Joseph Goldberger.

†No. 41.—Milk and its relation to the public health. By various authors.

†No. 42.—The thermal death points of pathogenic micro-organisms in milk. By M. J. Rosenau.

†No. 43.—The standardization of tetanus antitoxin (an American unit established under authority of the act of July 1, 1902). By M. J. Rosenau and John F. Anderson.

No. 44.—Report No. 2 on the origin and prevalence of typhoid fever in the District of Columbia, 1907. By M. J. Rosenau, L. L. Lumsden, and Joseph H. Kastle.

†No. 45.—Further studies upon anaphylaxis. By M. J. Rosenau and John F. Anderson.

†No. 46.—*Hepatozoon perniciosum* (n. g., n. sp.); a hæmogregarine pathogenic for white rats; with a description of the sexual cycle in the intermediate host, a mite (*lelaps echidnimus*). By W. W. Miller.

No. 47.—Studies on Thyroid: I. The relation of iodine to the physiological activity of thyroid preparations. By Reid Hunt and Atherton Seidell.

†No. 48.—The physiological standardization of digitalis. By Charles Wallis Edmunds and Worth Hale.

No. 49.—Digest of comments on the United States pharmacopœia. Eighth decennial revision for the period ending December 31, 1905. By Murray Galt Motter and Martin I. Wilbert.

No. 50.—Further studies upon the phenomenon of anaphylaxis. By M. J. Rosenau and John F. Anderson.

No. 51.—Chemical tests for blood. By Joseph H. Kastle.

No. 52.—Report No. 3 on the origin and prevalence of typhoid fever in the District of Columbia (1908). By M. J. Rosenau, Leslie L. Lumsden, and Joseph H. Kastle.

No. 53.—The influence of certain drugs upon the toxicity of acetanilide and antipyrine. By Worth Hale.

No. 54.—The fixing power of alkaloids on volatile acids and its application to the estimation of alkaloids with the aid of phenolphthalein or by the Volhard method. By Elias Elvolve.

No. 55.—Quantitative pharmacological studies; adrenalin and adrenalin-like bodies. By W. H. Schultz.

No. 56.—Milk and its relation to the public health. (Revised edition of Bulletin No. 41.) By various authors.

No. 57.—I. The presence of tubercle bacilli in the circulating blood in clinical and experimental tuberculosis. By John F. Anderson. II. The viability of the tubercle bacillus. By M. J. Rosenau.

No. 58.—Digest of comments on the pharmacopœia of the United States of America (eighth decennial revision) and the national formulary for the period ending December 31, 1906. By Murray Galt Motter and Martin I. Wilbert.

No. 59.—The oxidases and other oxygen catalysts concerned in biological oxidations. By Joseph Hoeing Kastle.

No. 60.—A study of the anatomy of Watsonius (n. g.) Watsoni of man and of 19 allied species of mammalian trematode worms of the superfamily Paramphistomoidea. By Ch. Wardell Stiles and Joseph Goldberger.

No. 61.—Quantitative pharmacological studies: Relative physiological activity of some commercial solutions of epinephrin. By W. H. Schultz.

No. 62.—The taxonomic value of the microscopic structure of the stigmal plates in the tick genus Dermacentor. By Ch. Wardell Stiles.

†No. 63.—Digest of comments on the pharmacopœia of the United States of America (eighth decennial revision) and the national formulary (third edition) for the calendar year ending December 31, 1907. By Murray Galt Motter and Martin I. Wilbert.

†No. 64.—Studies upon anaphylaxis with special reference to the antibodies concerned. By John F. Anderson and W. H. Frost.

No. 65.—Facts and problems of rabies. By A. M. Stimson.

†No. 66.—I. The influence of age and temperature on the potency of diphtheria antitoxin. By John F. Anderson. II. An organism (*Pseudomonas protea*) isolated from water, agglutinated by the serum of typhoid fever patients. By W. H. Frost. III. Some considerations on colorimetry, and a new colorimeter. By Norman Roberts. IV. A gas generator, in four forms, for laboratory and technical use. By Norman Roberts.

†No. 67.—The solubilities of the pharmacopœial organic acids and their salts. By Atherton Seidell.

†No. 68.—The bleaching of flour and the effect of nitrites on certain medicinal substances. By Worth Hale.

No. 69.—The effects of restricted diet and of various diets upon the resistance of animals to certain poisons. By Reid Hunt.

No. 70.—A study of melting-point determinations with special reference to the melting-point requirements of the United States pharmacopœia. By George A. Menge.

No. 71.—1. Some known and three new endoparasitic trematodes from American fresh-water fish. By Joseph Goldberger. 2. On some new parasitic trematode worms of the genus *Telorchis*. By Joseph Goldberger. 3. A new species of Athesmia from a monkey. By Joseph Goldberger and Charles G. Crane.

†No. 72.—I. Report on an outbreak of typhoid fever at Omaha, Nebr. (1909–1910). By L. L. Lumsden. II. The water supply of Williamson, W. Va., and its relation to an epidemic of typhoid fever. By W. H. Frost.

No. 73.—The effect of a number of derivatives of choline and analogous compounds on the blood pressure. By Reid Hunt and R. de M. Taveau.

†No. 74.—Digitalis standardization and the variability of crude and of medicinal preparations. By Worth Hale.

No. 75.—Digest of comments on the pharmacopœia of the United States of America (eighth decennial revision) and the national formulary (third edition) for the calendar year ending December 31, 1908. By Murray Galt Motter and Martin I. Wilbert.

No. 76.—The physiological standardization of ergot. By Charles Wallis Edmunds and Worth Hale.

No. 77.—Sewage pollution of interstate and international waters, with special reference to the spread of typhoid fever. By Allan J. McLaughlin.

No. 78.—Report No. 4 on the origin and prevalence of typhoid fever in the District of Columbia (1909). By L. L. Lumsden and John F. Anderson. (Including articles contributed by Thomas B. McClintic and Wade H. Frost.)

†No. 79.—Digest of comments on the pharmacopœia of the United States of America (eighth decennial revision) and the national formulary (third edition) for the calendar year ending December 31, 1909. By Murray Galt Motter and Martin I. Wilbert.

†No. 80.—Physiological studies in anaphylaxis. Reaction of smooth muscle from various organs of different animals to proteins. (Including reaction of muscle from nonsensitized, sensitized, tolerant, and immunized guinea pigs.) By William H. Schultz.

No. 81.—Tissue proliferation in plasma medium. By John Sundwall.

No. 82.—I. Method of standardizing disinfectants with and without organic matter. By John F. Anderson and Thomas B. McClintic. II. The determination of the phenol coefficient of some commercial disinfectants. By Thomas B. McClintic.

†No. 83.—I. Sewage pollution of interstate and international waters with special reference to the spread of typhoid fever. II. Lake Superior and St. Marys River. III. Lake Michigan and the Straits of Mackinac. IV. Lake Huron, St. Clair River, Lake St. Clair, and the Detroit River. V. Lake Ontario and St. Lawrence River. By Allan J. McLaughlin.

†No. 84. Digest of comments on the pharmacopœia of the United States of America (eighth decennial revision) and the national formulary (third edition) for the calendar year ending December 31, 1910. By Murray Galt Motter and Martin I. Wilbert.

†No. 85.—Index catalogue of medical and veterinary zoology. Subjects: Cestoda and cestodaria. By Ch. Wardell Stiles and Albert Hassall.

By act of Congress approved August 14, 1912, the name of the "Public Health and Marine-Hospital Service of the United States" was changed to the "Public Health Service." Since the change in name the bulletins of the Hygienic Laboratory have been issued without break in their numerical order.

†No. 86.—Studies on typhus. By John F. Anderson and Joseph Goldberger.

No. 87.—Digest of comments on the pharmacopœia of the United States of America (eighth decennial revision) and on the national formulary (third edition) for the calendar year ending December 31, 1911. By Murray Galt Motter and Martin I. Wilbert.

No. 88.—Method for determining the toxicity of coal-tar disinfectants, together with a report on the relative toxicity of some commercial disinfectants. By Worth Hale.

No. 89.—Sewage pollution of interstate and international waters with special reference to the spread of typhoid fever. VI. The Missouri River from Sioux City to its mouth. By Allan J. McLaughlin.

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No. 94.—I. Collected studies on the insect transmission of *Trypanosoma evansi*. By M. Bruin Mitzmain. II. Summary of experiments in the transmission of anthrax by biting flies. By M. Bruin Mitzmain.

No. 95. Laboratory studies on tetanus. By Edward Francis.

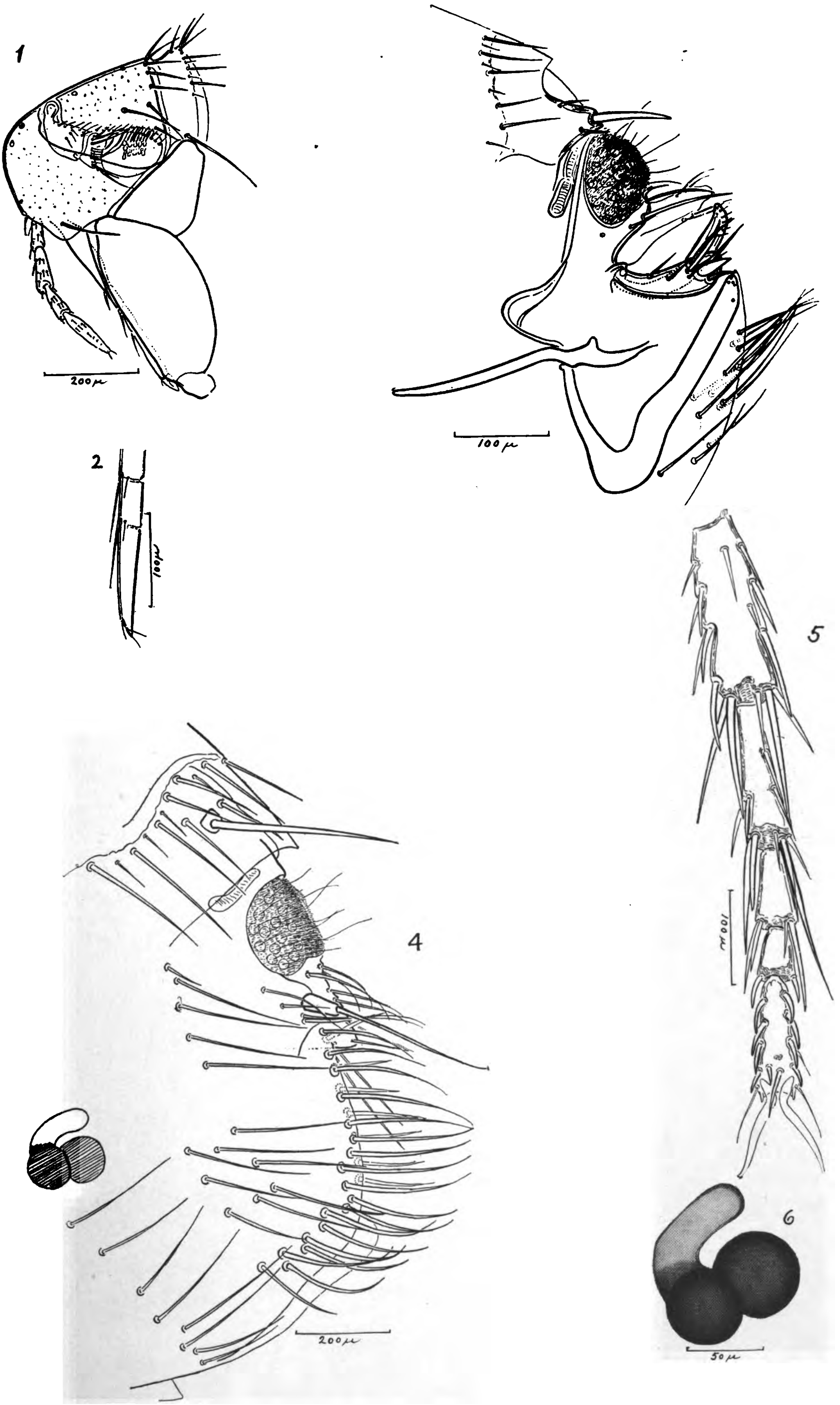
No. 96.—1. Report of investigation of coastal waters in the vicinity of Gulfport and Biloxi, Miss., with special reference to the pollution of shellfish. By R. H. Creel. 2. A comparison of methods for the determination of oxygen in waters in presence of nitrite. By Elias Elvove. 3. Some new compounds of the choline type. III. Including preparation of monacetate of α, β dioxy- β-methyl butane. By G. A. Menge. 4. The detection of white phosphorus in matches. By Earle B. Phelps. 5. The chemical composition of rubber used in nursing nipples and in some rubber toys. By Earle B. Phelps and Albert F. Stevenson. 6. The analysis of thymol capsules. By Atherton Seidell. 7. Seasonal variation in the composition of the thyroid gland. By Atherton Seidell and Frederic Fenger. 8. Note on a new apparatus for use with the Winkler method for dissolved oxygen in water. By Hyman Shoub. 9. The pharmacological action of some serum preservatives. By Carl Voegtlin.

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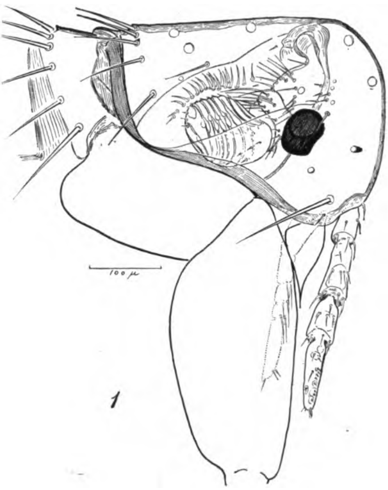
The editions of the publications marked (*) are no longer available for distribution by the Surgeon General of the Public Health Service. Copies of those marked (†) may, however, be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., who sells publications at cost, and to whom requests for publications thus marked should be made.

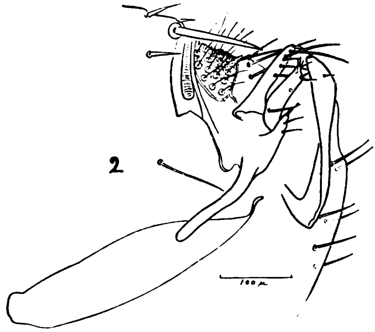


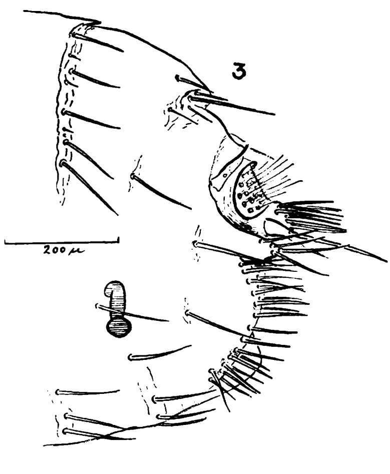
L. H. Wilder.

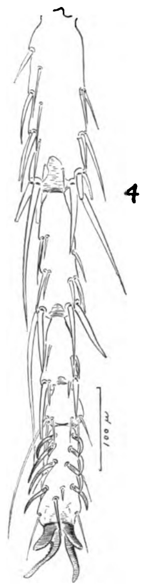
ROOSEVELTIELLA GEORYCHI.

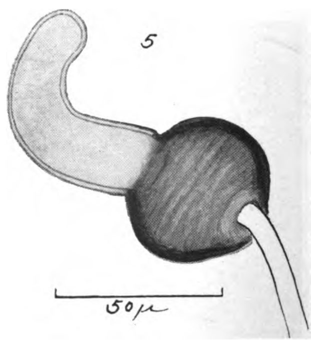
PLATE II.





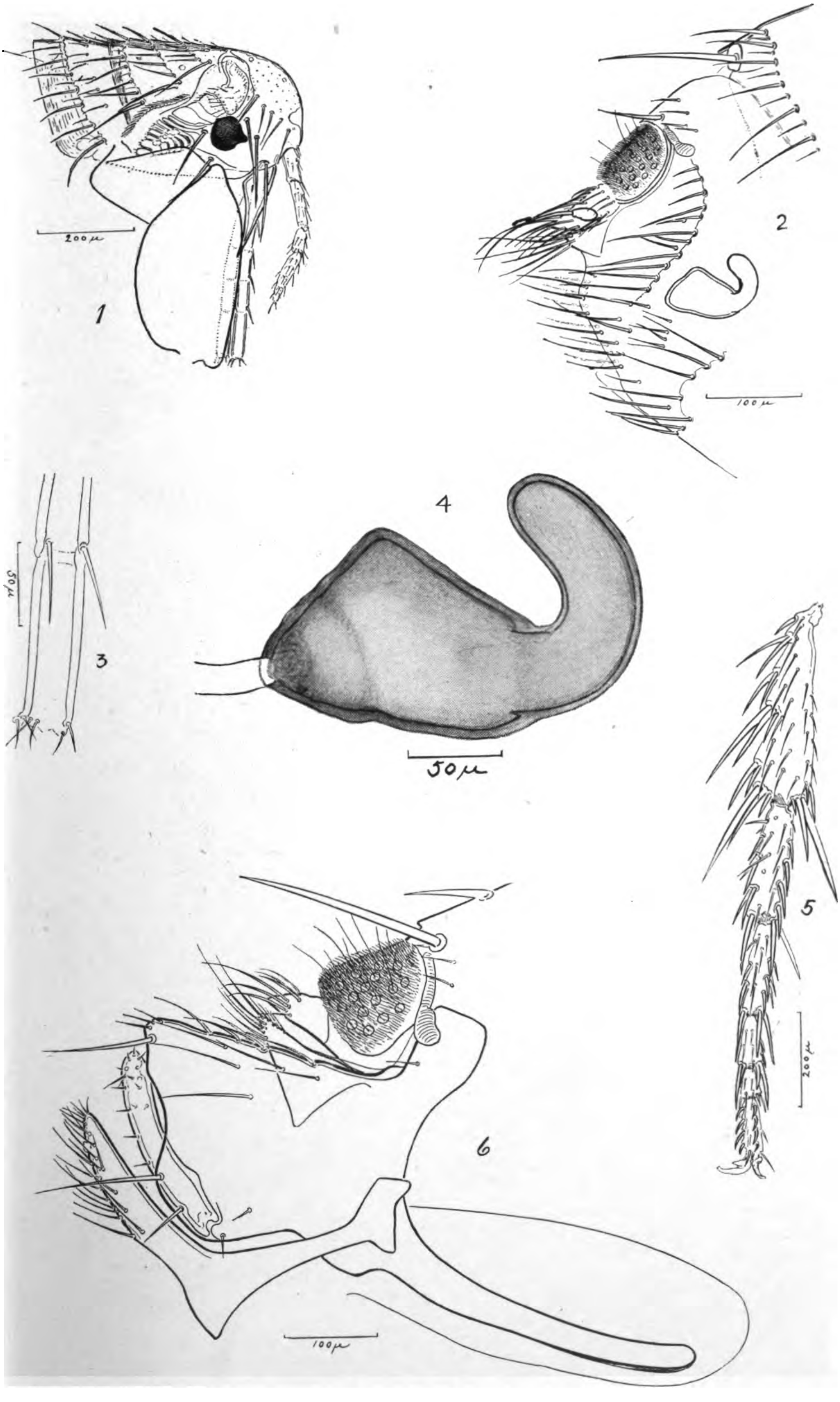






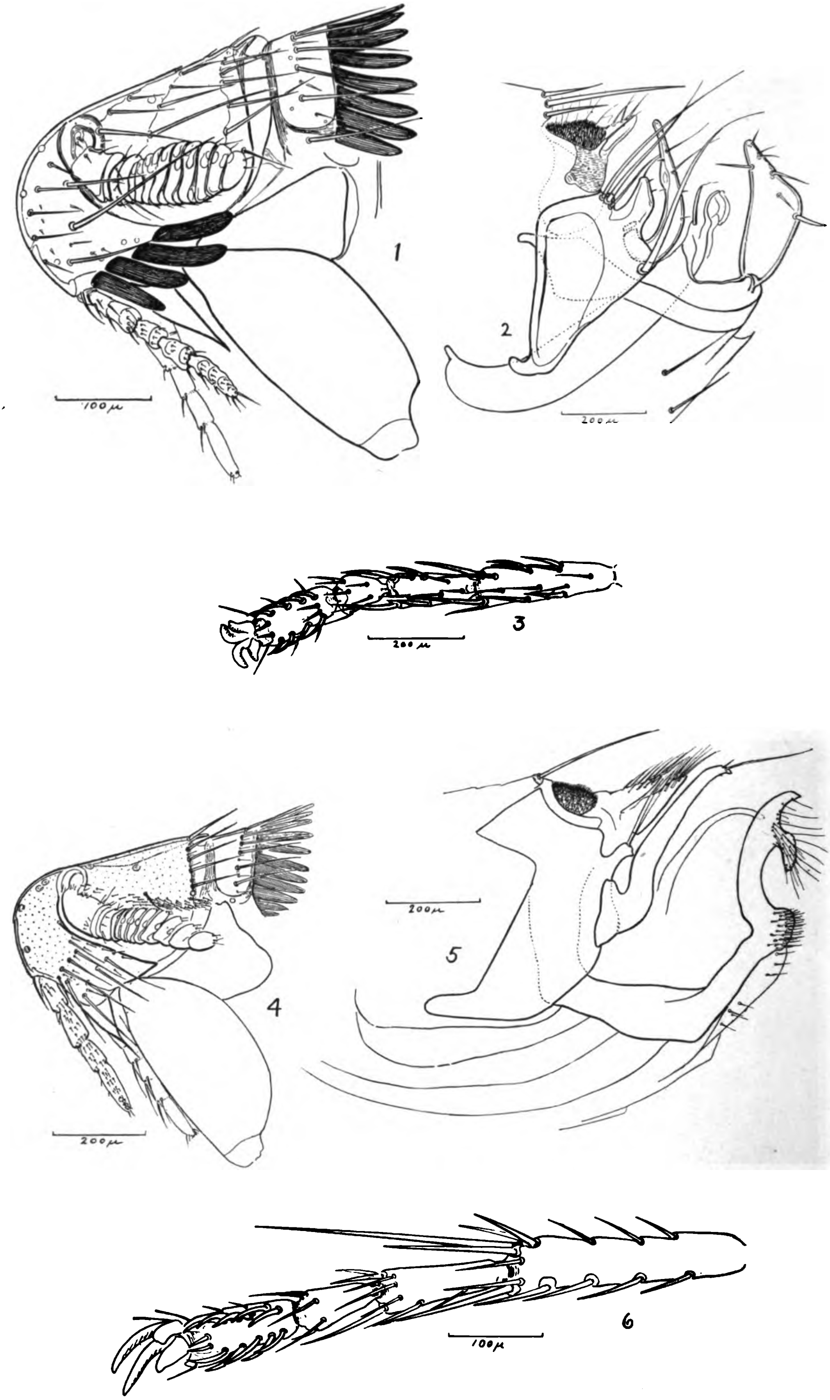
L. H. Wilder.

XENOPSYLLA PROCAVIAE.



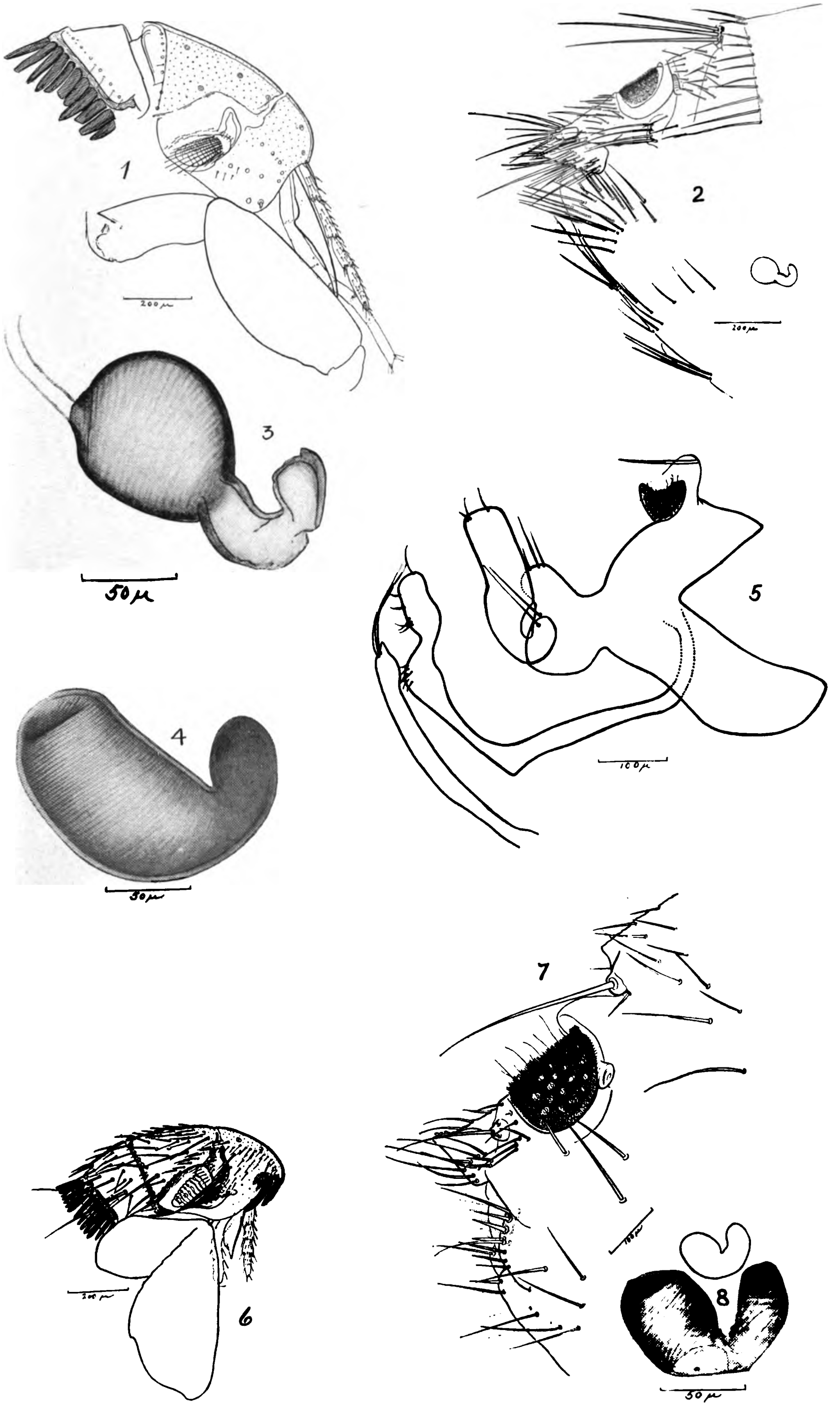
RHOPALOPSYLLUS GWYNI.

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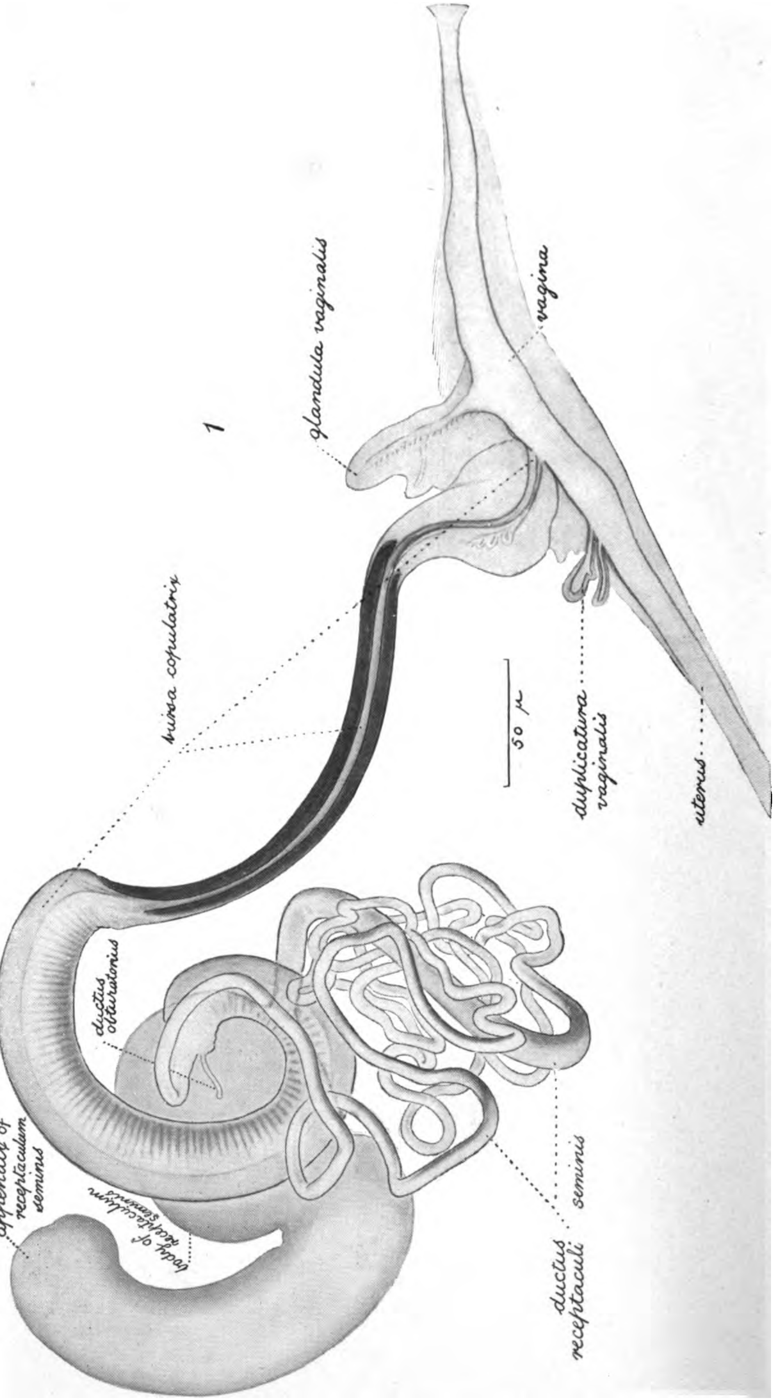
L. H. Wilder.

DORATOPSYLLA BLARINAE. CERATOPHYLLUS STIMSONI.

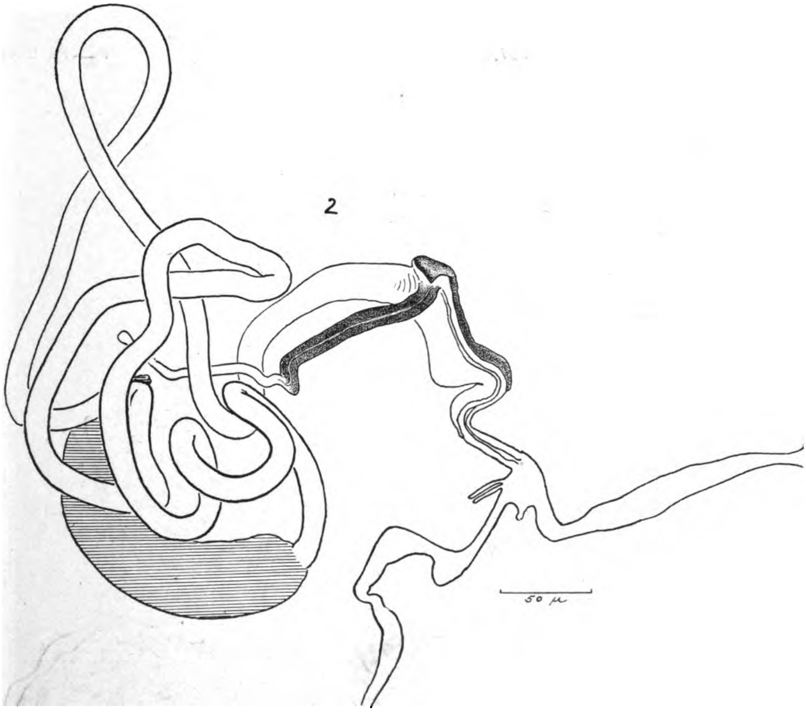


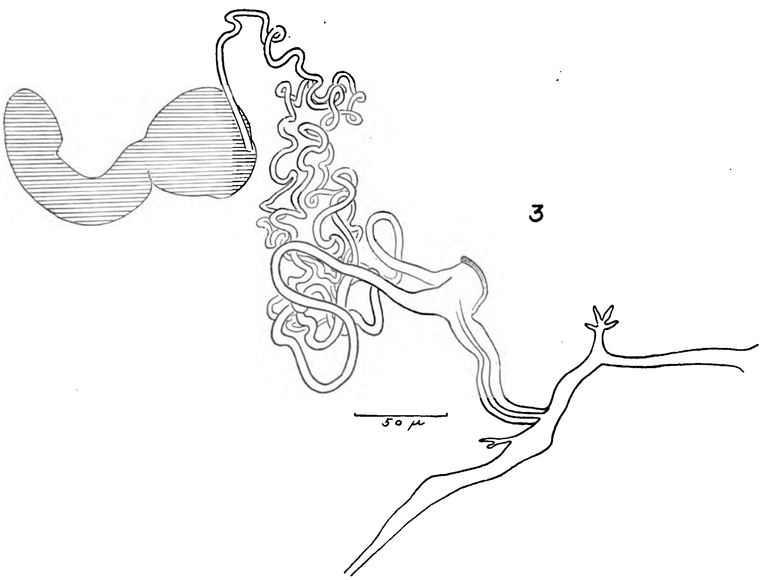
L. H. Wilder.

CERATOPHYLLUS APACHINUS. CERATOPHYLLUS GIBSONI. ISCHNOPSYLLUS TEXANUS.

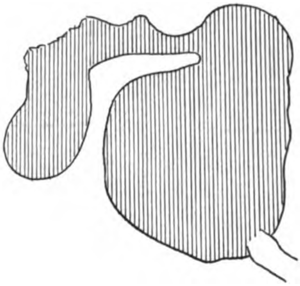

1
glandula vaginalis
vagina
bursa copulatrix
50 μ
duplicatura vaginalis
uterus
ductus obturatorius
appendix of receptaculum seminis
body of receptaculum seminis
ductus receptaculi seminis

L. H. Wilder.

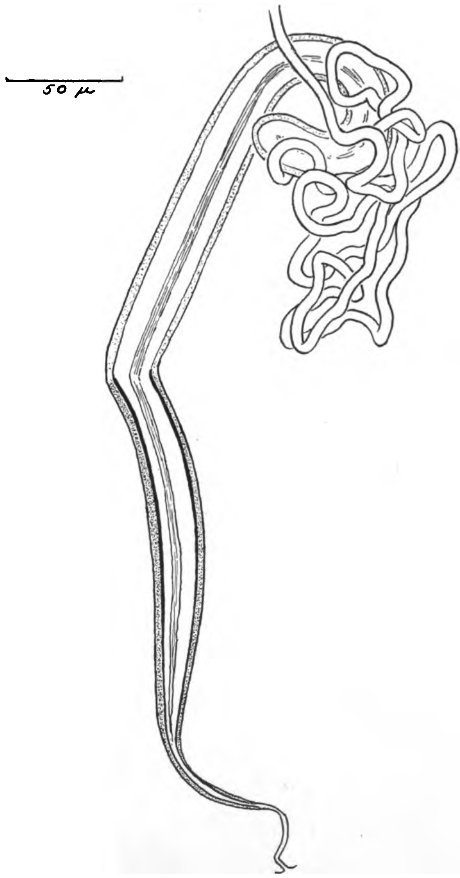




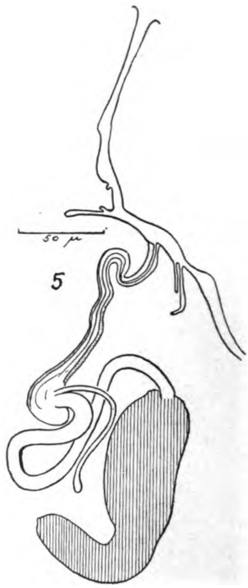
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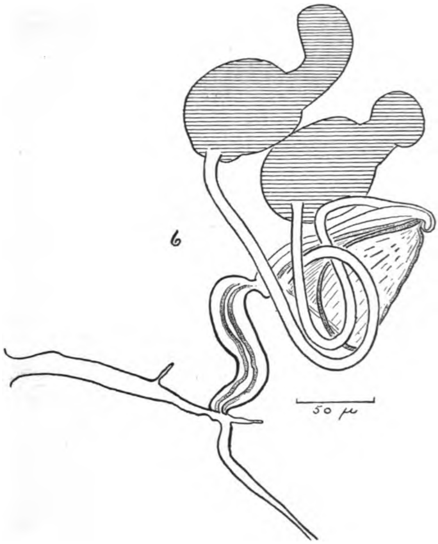


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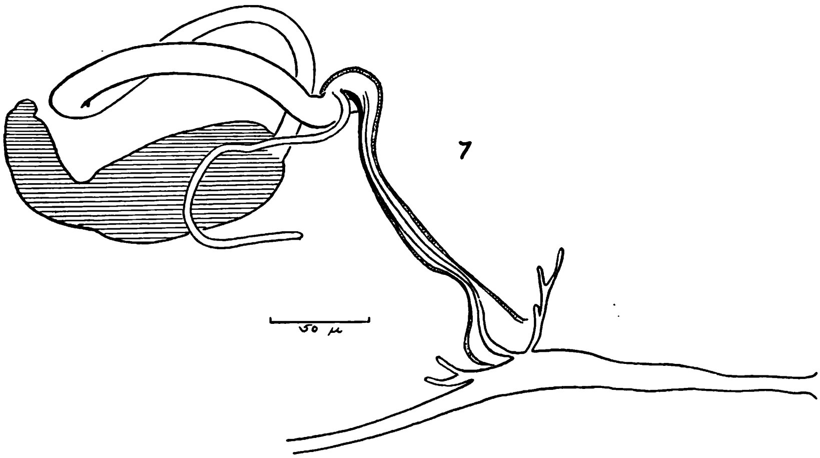


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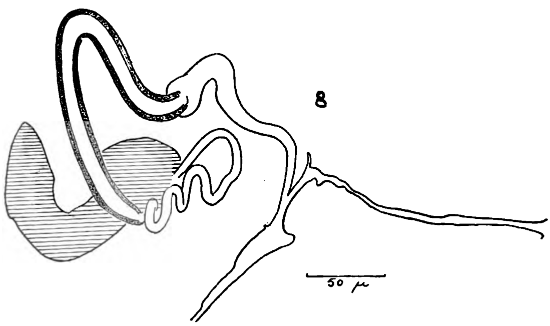
PLATE IX.



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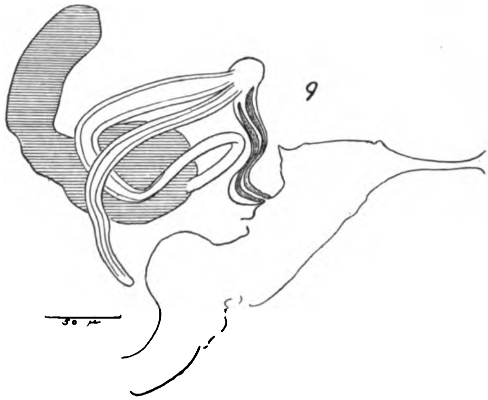


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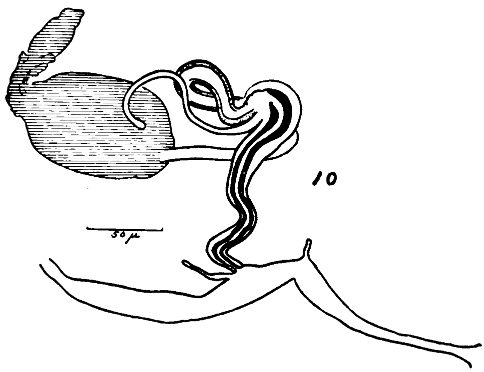


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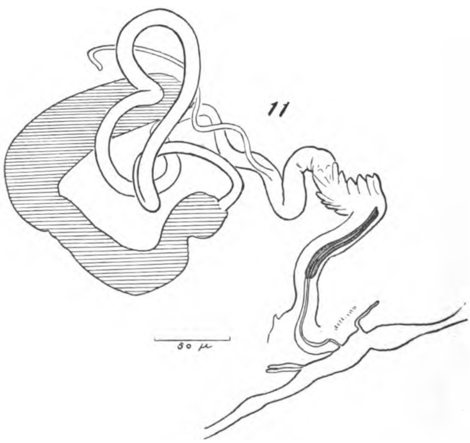
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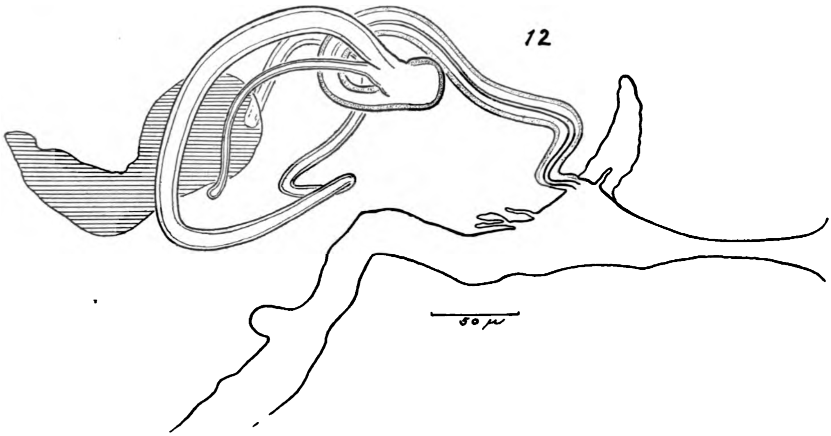


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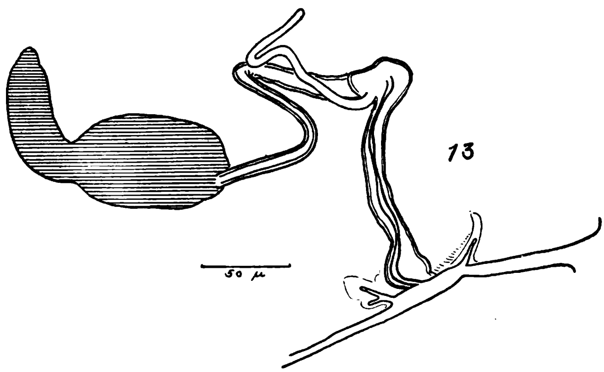


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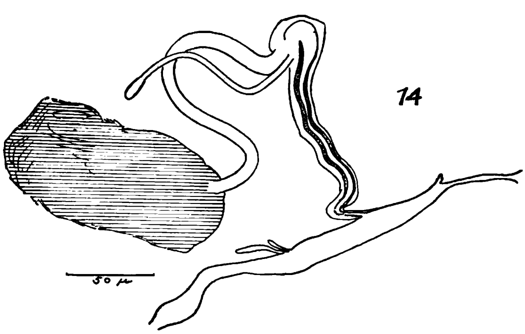
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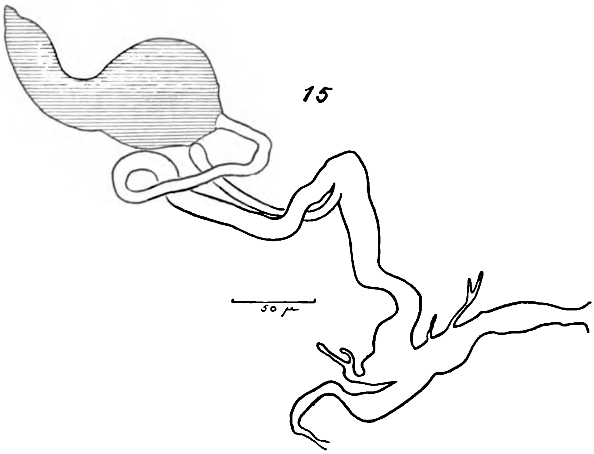


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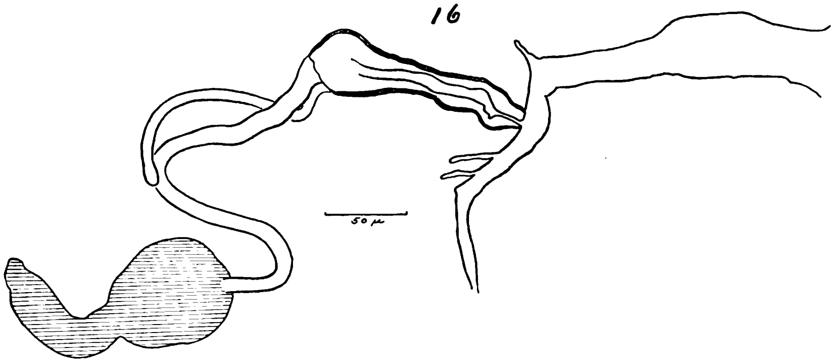


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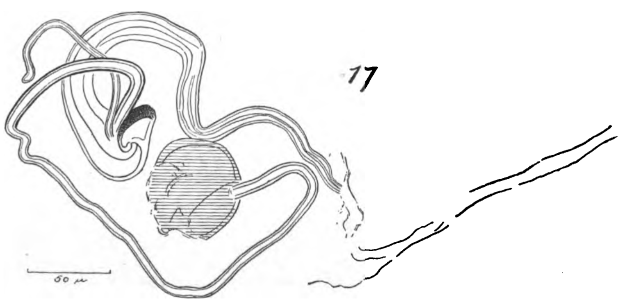
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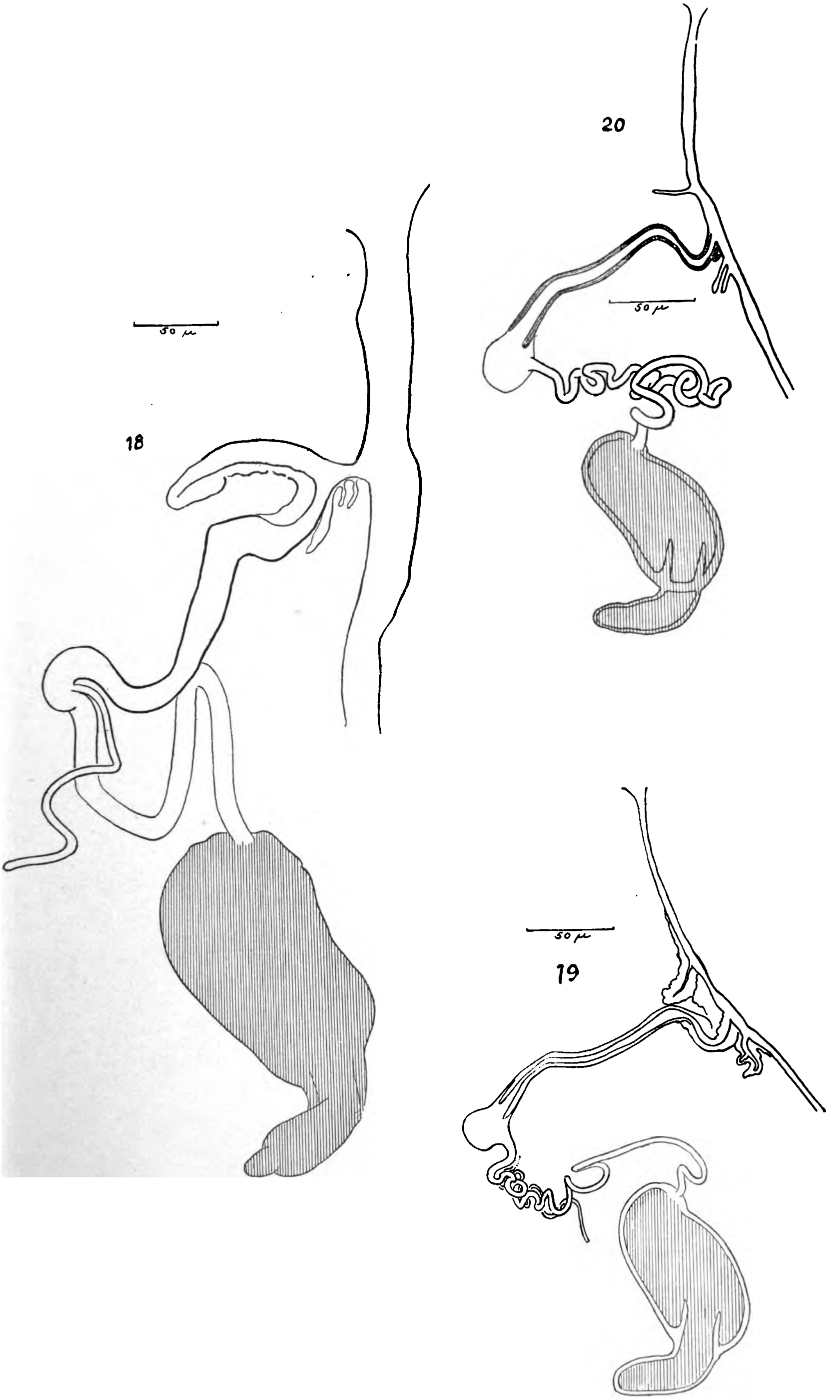


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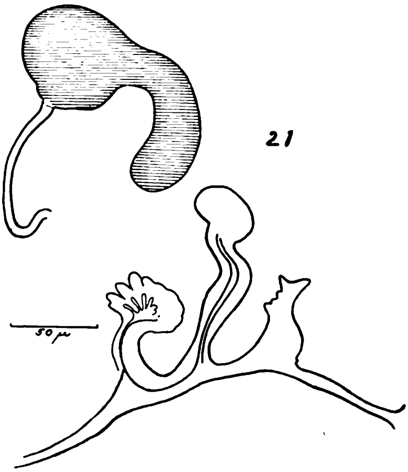


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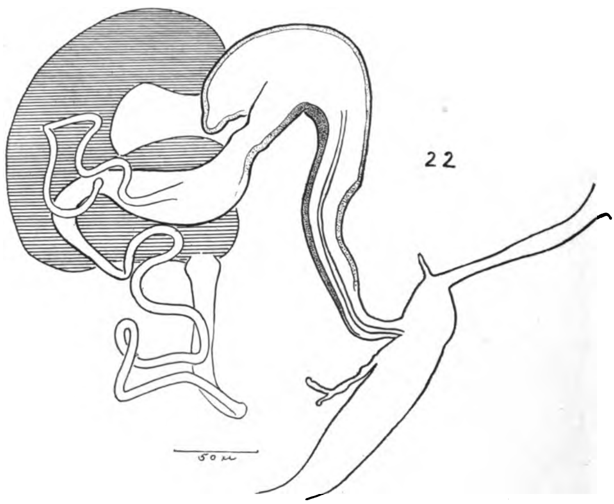
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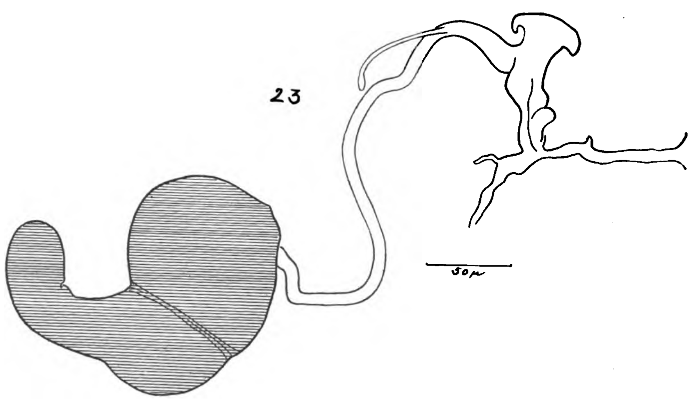


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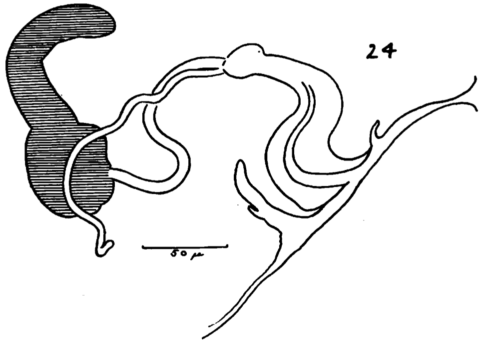
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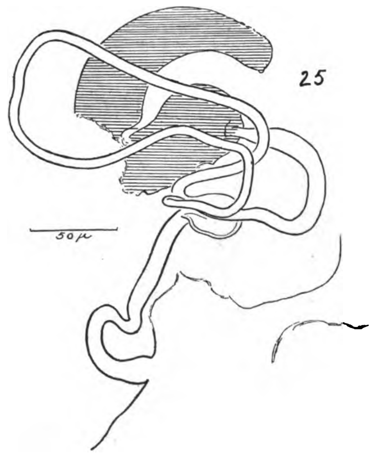


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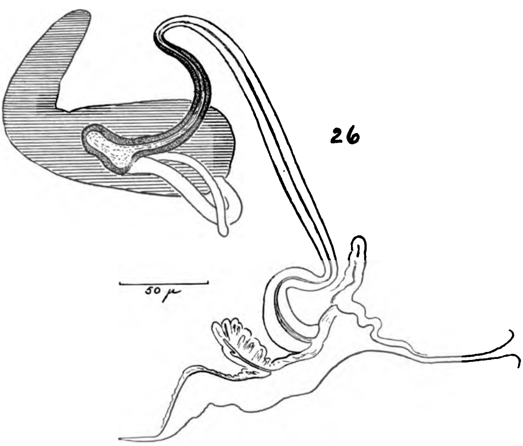
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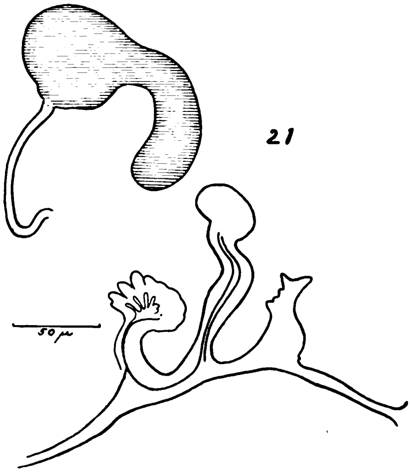
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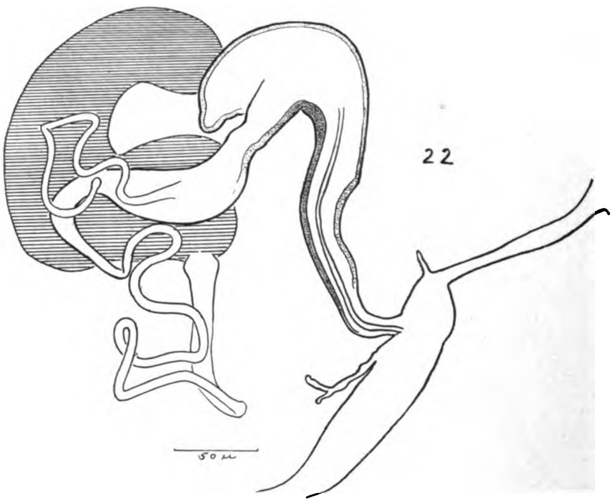
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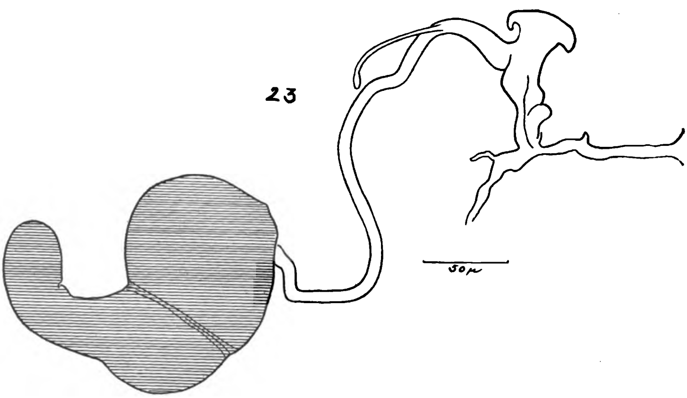


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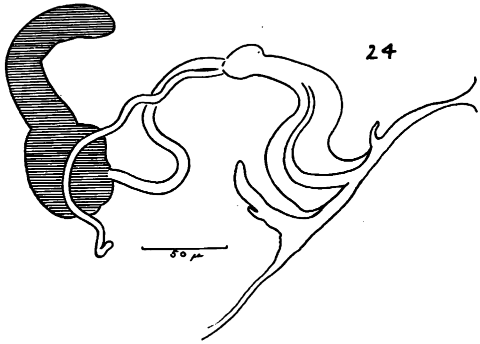


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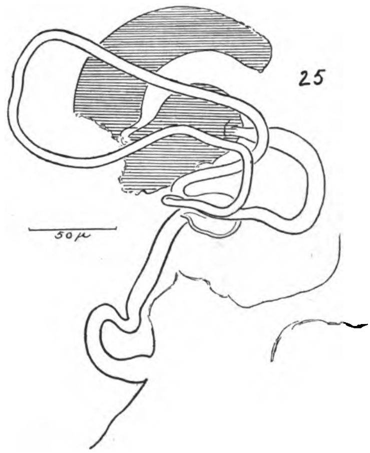
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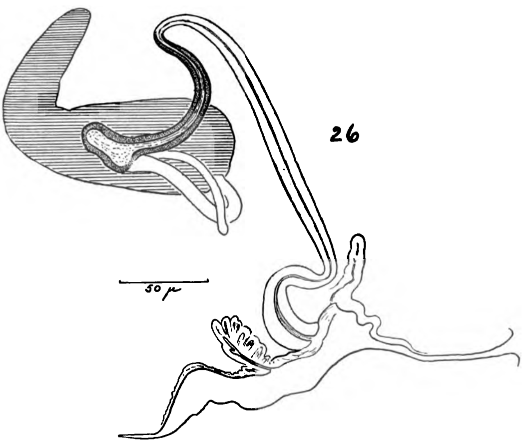
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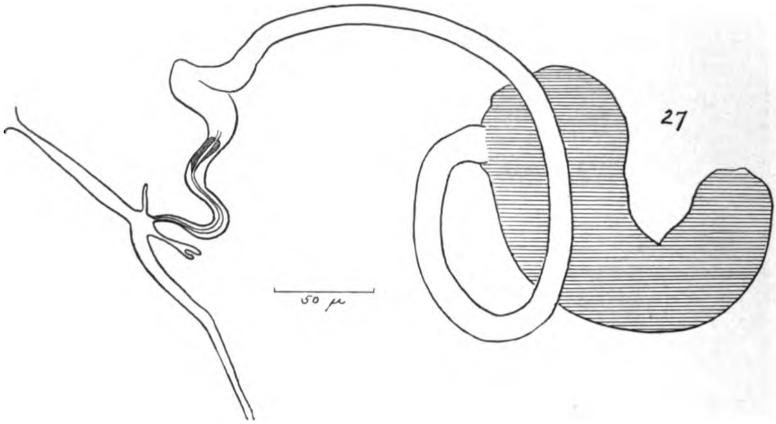


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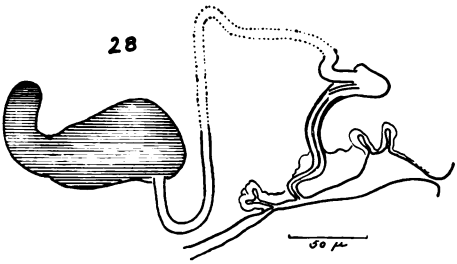


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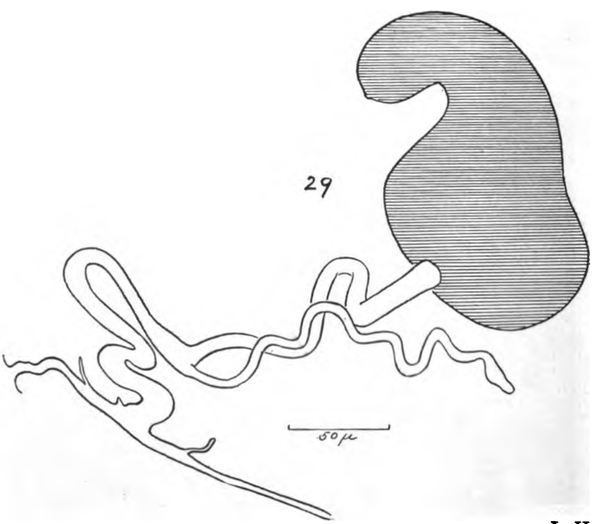
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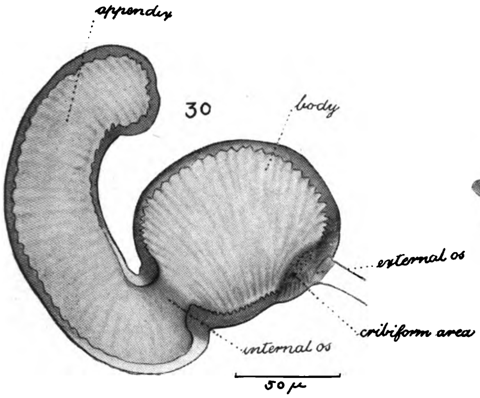


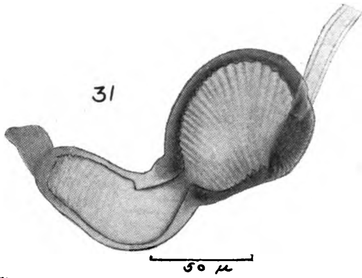
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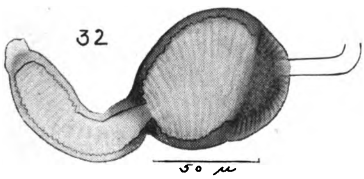


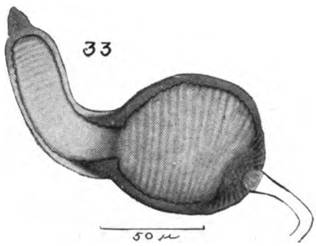
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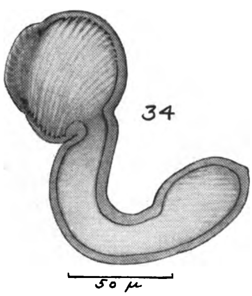
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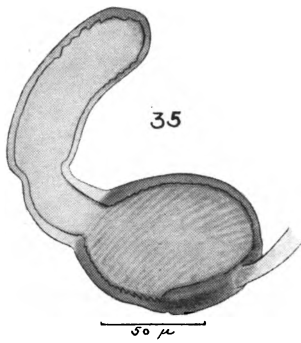

appendix
30
body
external os
cribriform area
internal os
50 μ

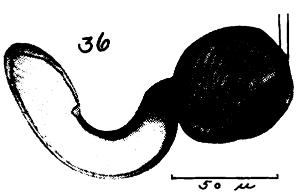

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50 μ

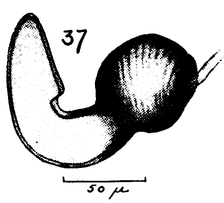

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50 μ


33
50 μ


34
50 μ


35
50 μ

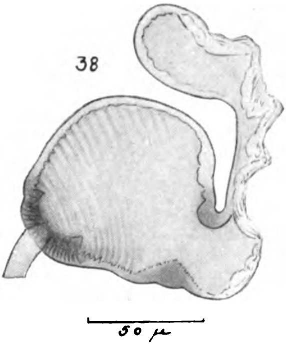

36
50 μ


37
50 μ

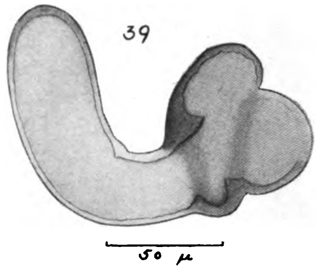
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PLATE XVIII.

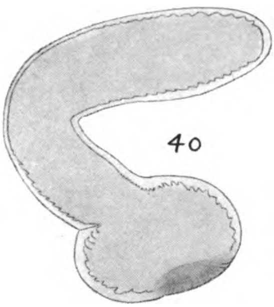
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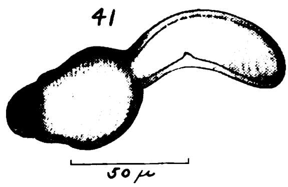
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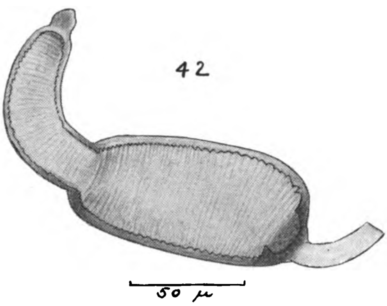
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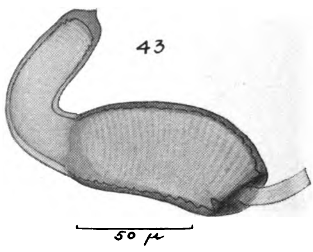
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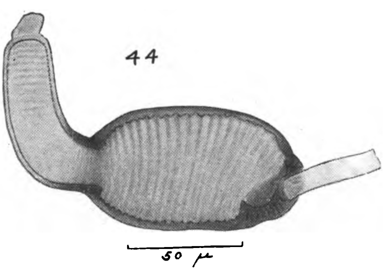
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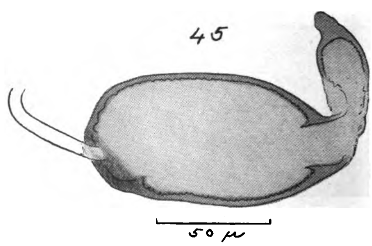
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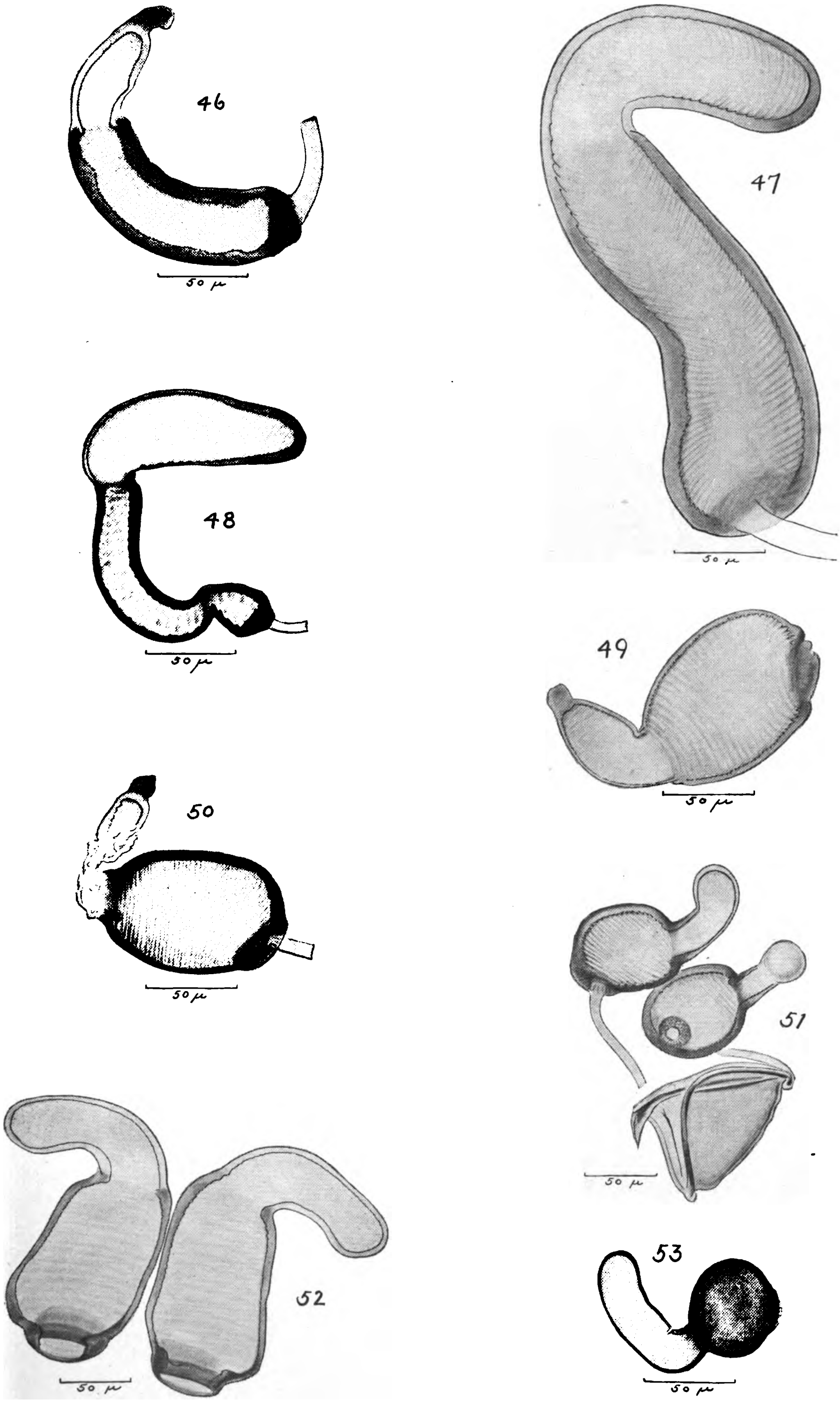


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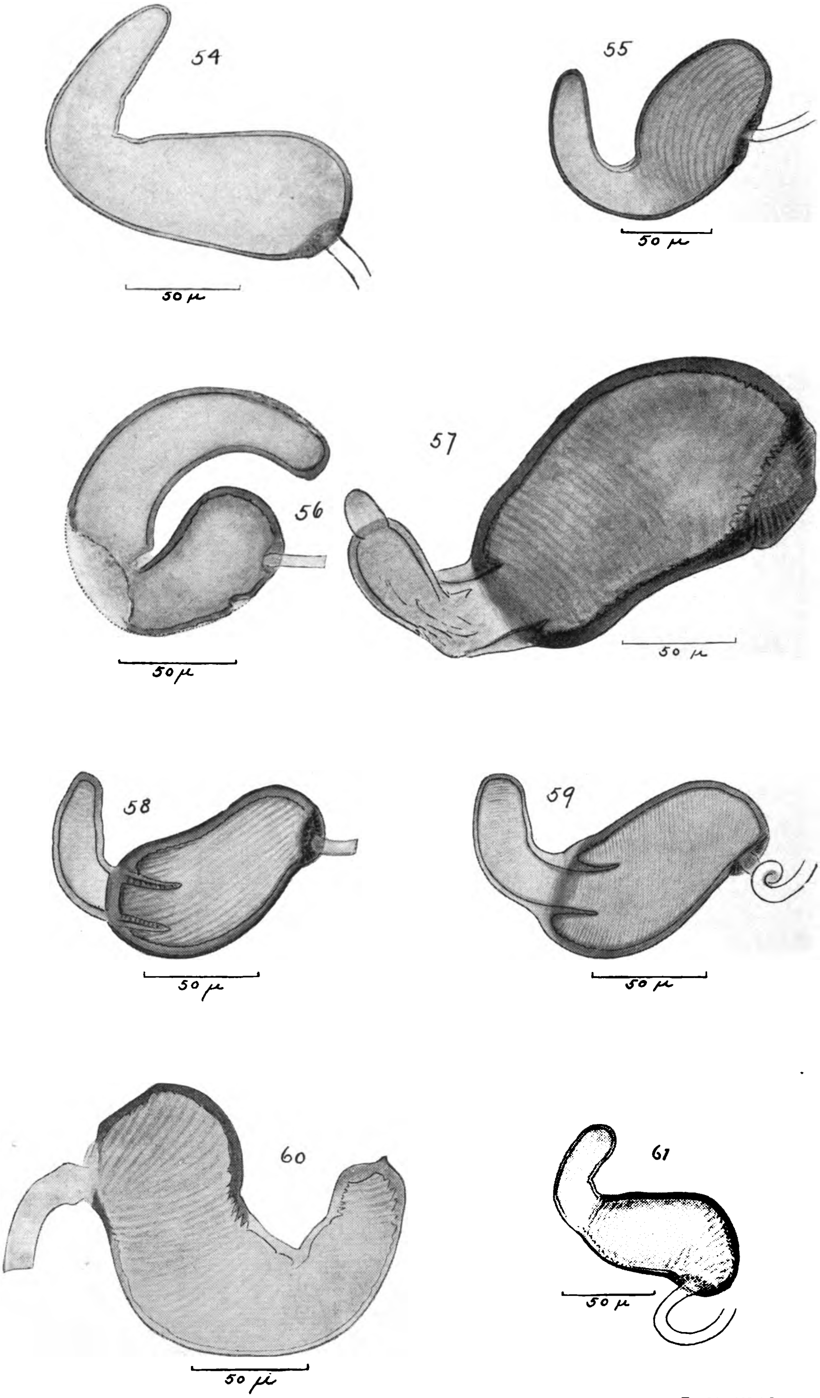


L. H. Wilder.

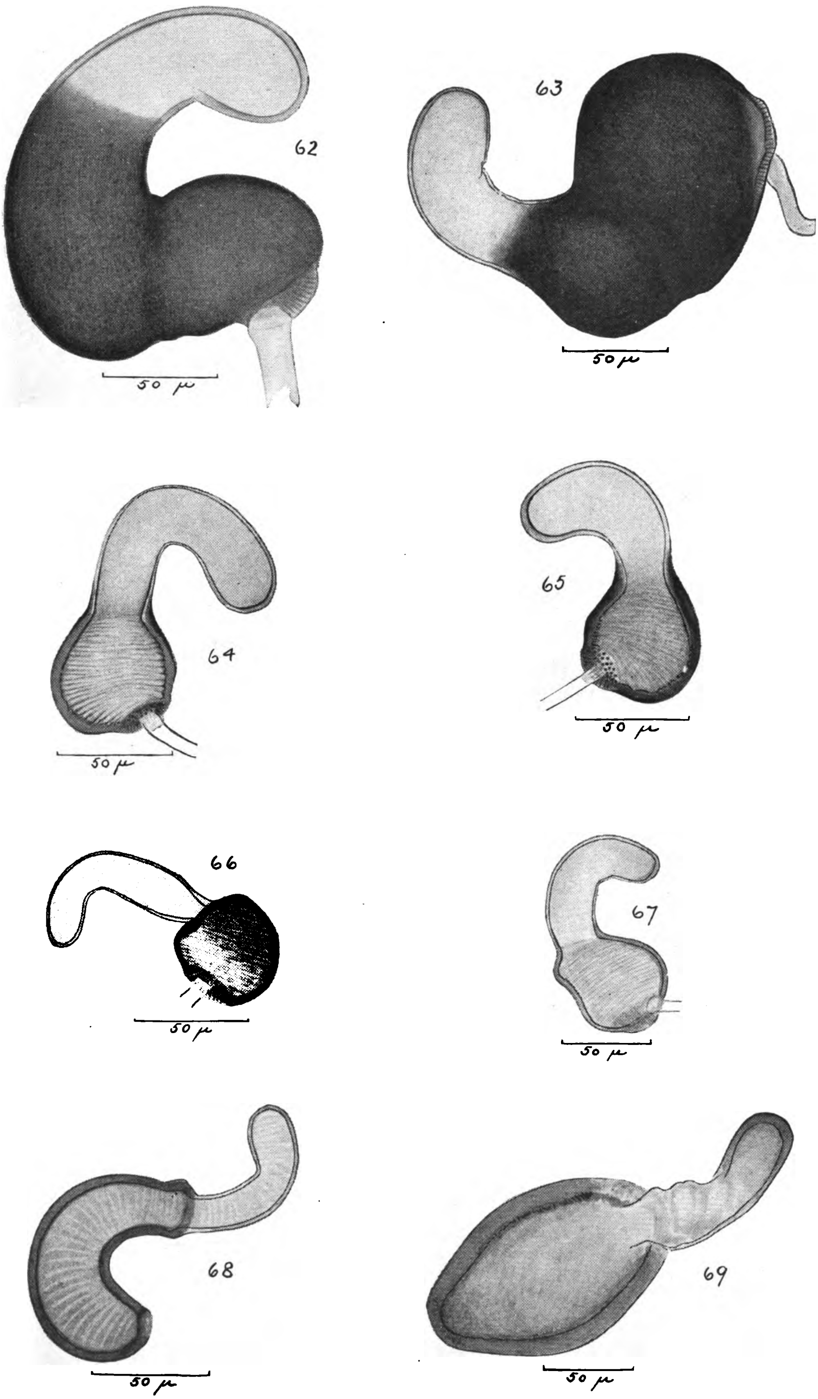
PLATE XIX.



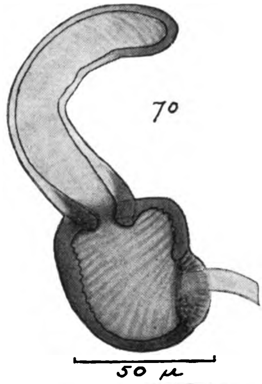
L. H. Wilder.



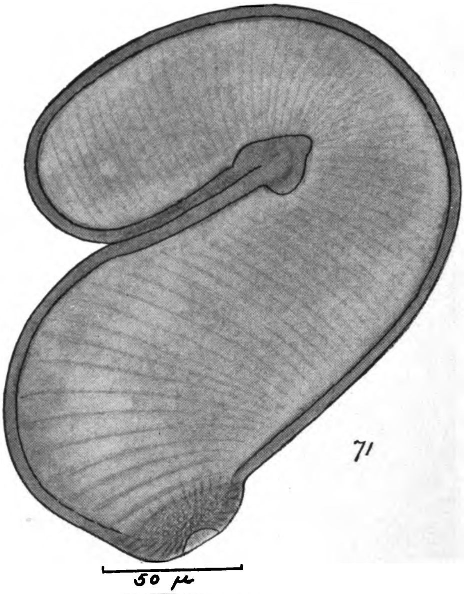
L. H. Wilder.



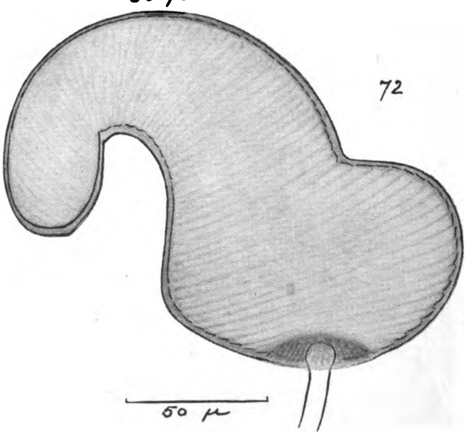
L. H. Wilder.



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L. H. Wilder.